



Australian Government
**Department of Resources,
Energy and Tourism**

GUIDE TO SAFE TRANSPORT OF URANIUM OXIDE CONCENTRATE



Disclaimer

This publication has been developed by the Uranium Council Transport Working Group. The effort of all contributors is gratefully acknowledged.

The views and opinions expressed in this publication do not necessarily reflect those of the Commonwealth Government or the Minister for Resources and Energy and Minister for Tourism. While reasonable efforts have been made to ensure that the contents of this publication are factually correct, the Commonwealth does not accept responsibility for the accuracy or completeness of the contents, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.

Users of this publication should bear in mind that it is intended as a general reference and is not intended to replace the need for professional advice relevant to the particular circumstances of individual users. Reference to companies or products in this publication should not be taken as Commonwealth Government endorsement of those companies or their products.

© 2012 Commonwealth of Australia

ISBN

978-1-922106-11-7 (online)

978-1-922106-12-4 (print)



<http://creativecommons.org/licenses/by/3.0/au/>

This report is licensed under a Creative Commons Attribution 3.0 Australia licence. To the extent that copyright subsists in third party quotes and diagrams it remains with the original owner and permission may be required to reuse the material.

The report should be attributed as the Guide to the Safe Transport of Uranium Oxide Concentrate. Guide to Safe Transport is available online at <http://www.ret.gov.au/uranium.council>

Enquiries regarding the licence and any use of the report are welcome at uranium@ret.gov.au.

For further information contact uranium@ret.gov.au.

Foreword



As one of the world's largest producers of uranium, Australia supports the sustainable development and responsible use of this globally important energy resource. The continued success of this industry relies on stringent policies and practices for the safe transport of uranium oxide concentrates (UOC).

The Australian Government is committed to meeting international standards for the transport of UOC. The Australian Radiation Protection and Nuclear Safety Agency has adopted the International Atomic Energy Agency's transport regulations into a nationally consistent Code of Practice for the Safe Transport of Radioactive Substances (the Code). The Code has been adopted in all jurisdictions of Australia.

This guide is a consolidation of widely adopted and applied procedures for the safe transport of UOC and is consistent with the Code. Government and industry experts guided its development and it is an important reference for all stakeholders. This guide provides best practice advice on radiation protection, packaging and labelling standards, and emergency response procedures. I support the publication of this guide to promote widespread consistency and understanding of the practices within the Australian uranium industry.

I am proud of Australia's position as a global leader in this industry and our success in safely transporting UOC internationally for over 30 years. As the Minister for Resources and Energy, I am pleased to endorse this guide as a leading practice reference for industry. I would especially like to acknowledge the work of the Uranium Council's Transport Working Group, in particular its chair Frank Boulton, for developing these documents.

A handwritten signature in blue ink, appearing to read 'Martin Ferguson'. The signature is fluid and cursive.

Martin Ferguson AM MP
Minister for Resources and Energy

URANIUM COUNCIL

Transport Working Group

Guide to Safe Transport of Uranium Oxide Concentrate

| | |
|--|----|
| 1. Guide to the safe transport of uranium oxide concentrate | 7 |
| 2. Radiation protection and UOC | 13 |
| 3. Guide to packaging and stowage of shipping containers carrying UOC. | 15 |
| 4. Safety Data Sheet for drummed UOC as U ₃ O ₈ | 19 |
| 5. Documentation required to transit Class 7 cargo through ports | 29 |
| 6. Responding to an incident while transporting UOC | 31 |
| 7. Guidance on the creation of incident response action plans | 43 |
| 8. Guide to the transportation of radioactive materials for testing | 57 |
| 9. List of Australian Competent Authorities | 69 |



Chapter 1: Guide to the safe transport of uranium oxide concentrate

Information for regulators, carriers, terminal and port operators regarding the handling, storage and transport of drummed uranium oxide concentrate (UOC) in 20-foot ISO shipping containers.

What is uranium oxide concentrate (UOC)?

Uranium (U) is a naturally occurring, mildly radioactive element that is widely distributed in the Earth's crust, rivers and oceans. Traces are also found in the human body and in food. Uranium is mined and processed into uranium ore concentrate which contains uranium oxide as either U_3O_8 , or as UO_4 and is commonly termed yellowcake, being exported in this powder form.

UOC is both chemically and physically stable, and can not itself sustain a nuclear chain reaction. It generally contains more than 80 per cent of uranium oxide and contains the mixture of uranium isotopes occurring in nature. Significant additional processing (conversion, enrichment and fuel fabrication) is required before it can be used to generate power. Australian uranium is only used for peaceful purposes as a fuel for civilian nuclear power and to produce medical and industrial isotopes.

| | |
|----------------------|---|
| Chemical Name | Uranium Ore Concentrate as Uranium Oxide U_3O_8 or Uranium Ore Concentrate as Uranium Oxide UO_4 |
| Proper shipping name | Radioactive Material, Low Specific Activity (LSA-1) Non-Fissile or Fissile – Excepted |
| Class number | 7 (Class 7 Radioactive material) |
| UN Number | UN2912 Class 7 Schedule No: 5, LSA-1 |
| Common Names | UOC, yellow cake, U_3O_8 |



Figures 1, 2 and 3:
Drums of UOC
being filled.

What are Class 7 Goods?

Everybody is exposed to radiation from a variety of natural and artificial sources every day. It is present in the environment because of naturally occurring radioactive minerals. The Class 7 Dangerous Goods classification covers all radioactive materials. UOC is treated as a Class 7 Dangerous Good for transportation because it is weakly radioactive. It is classified as a 'low specific activity' (LSA) material because of its low level of radioactivity per unit mass. The strict packaging requirements mean that any radiation exposure from the transport and handling of UOC is further minimised. However, as with any category of Dangerous Good, precautions need to be taken when handling UOC.

UOC remains stable under all conditions of storage, handling and transport. If proper procedures are followed there is little risk to handlers. The total time involved in handling or transporting UOC containers, combined with the very low levels of radiation, reduces the probability of receiving any hazardous exposure during handling or transportation. Exposure from this source is well below the regulator limit for transport workers; standing one metre from a UOC drum for one hour would have roughly the same additional radiation exposure (15 microsieverts (μSv)) above standard background radiation levels as a four-hour, high altitude commercial flight. (See Chapter 2: Radiation protection and UOC for further information).

Uranium in the Australian context

Australia has around one third of the world's commercially recoverable uranium, and is one of the world's largest producers. Exports are subject to strict safeguards and non-proliferation conditions to ensure that Australian uranium is only used for peaceful purposes.

Australian UOC is shipped to customers via countries that convert and enrich it to fabricate fuel. In 2011-12 Australia exported 6,917 tonnes of U_3O_8 valued at \$607 million. One tonne of natural uranium produces approximately 44 million kilowatt-hours of electricity¹. According to the Australian Academy of Sciences, one tonne of Australian uranium exports used to generate electricity eliminates 40,000 tonnes of carbon dioxide emissions, compared with the emissions that would have been emitted had the same amount of electricity been generated by conventional methods.

¹ World Nuclear Association, <<http://www.world-nuclear.org/info/inf03.html>>

Australian UOC is transported from the four operating mines in the Northern Territory and South Australia by road and rail to the ports of Adelaide and Darwin, where it is exported to converters overseas. As a responsible supplier of uranium, Australia has an important role to play in international efforts to build a safer future for nuclear power.

How is the transport of UOC regulated?

The international transport of nuclear materials, including UOC, has been carried out safely and routinely for over 45 years. During this period there has never been a transport incident that has caused significant radiological damage to people or the environment.

There are two main internationally applicable sets of requirements for the transport of radioactive material, which have been adopted into Australian regulation. This forms a consistent international framework for the transport of radioactive material.

- *International Atomic Energy Association (IAEA) Regulations for the Safe Transport of Radioactive Material (TS-R-1, or IAEA Regulations)*. The TS-R-1 have been adopted by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) in the *Code of Practice for the Safe Transport of Radioactive Substances* (the ARPANSA Code), which is then adopted by each of the states and territories.
- *International Maritime Dangerous Goods Code (IMDG Code)*. The IMDG requirements are based on, and mandate the use of the TS-R-1. The Australian Maritime Safety Authority (AMSA) is responsible for regulating the IMDG Code.

How is UOC packed and transported?

Australian UOC is packaged to comply with, and generally to exceed, all applicable national and international requirements. The method used by Australian producers is approved by AMSA. UOC is packed in sealed 200-litre steel drums meeting IP-1 (industrial package) standards.

Each drum has a tight fitting lid which is secured to the drum with a steel locking ring that is clamped by a locking ring bolt. Drums filled with UOC are stowed securely within 20-foot International Organization for Standardisation (ISO) sea freight containers (or cargo transport units (CTUs)) to international standards using a webbed Kevlar-based strapping system to withstand the G-forces expected during road, rail and sea transportation and associated handling operations. This arrangement for securing the drums in the CTU is approved by AMSA for sea transport. The UOC effectively has double encapsulation or 'wrap' protection, consisting of an inner sealed container (the drum) within an outer shipping container. This greatly reduces the likelihood of there being an incident involving a spillage of the material.

The packed containers are placarded and marked to comply with transport requirements. They are then inspected and sealed with consecutively numbered bolt-type seals affixed to the door of each container at the mine site.



This ensures that containers remain sealed throughout the journey from mine to final overseas point of delivery. Container seals are checked for integrity at all trans-shipment and discharge points. The securing and stowage position of CTUs on the vessel is also required to be to AMSA satisfaction.

Figures 4, 5, 6, and 7: Drums of UOC being packed into 20-foot ISO shipping containers.

All Australian UOC transported by sea is stowed under deck, generally door to door. This minimises the opportunity for the container doors to open should some external event trigger a significant force or impact upon the containers. These packaging requirements greatly reduce the likelihood of there being an event which could lead to a spill. Specific packaging information can be found in *Chapter 3: Guide to packaging and stowage of shipping containers carrying UOC*.

It is also important that samples of uranium oxide, uranium ore and disequilibrium consignments are packaged and transported safely and securely. These samples are transported within Australia and internationally for analysis and testing. For further information on the requirements for transporting radioactive samples, refer to *Chapter 8: Guide to the transportation of radioactive materials for testing*.



Figure 8: Checking radiation levels in the truck driver's cabin.



Figure 9: Placement of containers into under-deck holds.

What shipping documentation and notifications are required?

A number of different types of documentation accompany each shipment of UOC. A key document is the Safety Data Sheet (SDS) which describes the hazard identification information on UOC, and first aid, fire fighting and accidental release measures. The SDS must accompany all shipments and is provided to ships crews and made available to ports and container terminals. A sample SDS can be found at *Chapter 4: Safety Data Sheet for UOC as U₃O₈*.

UOC also requires government approval for export, transit and trans-shipment. For further information on the documentation required for the transport of UOC, refer to *Chapter 5: Documentation required to transit Class 7 cargo through ports*. The robust regulation and secure packaging methods for UOC means that public notification of UOC shipments or trans-shipments should be no different from the public notification requirements that apply to other Dangerous Goods categories. Refer to the relevant Competent Authority for further information on public notification requirements.

A list of Australian Competent Authorities can be found at *Chapter 9: List of Australian Competent Authorities*, and at the following website:

www.arpansa.gov.au/pubs/rps/comp_auth.pdf

A list of international Competent Authorities can be found here:

www-ns.iaea.org/downloads/rw/transport-safety/transport-safety-nca-list.pdf

What are the risks of an incident?

The safety and security arrangements for transporting UOC mean that an accident is unlikely and if it occurs, is unlikely to result in any environmental or health issues. UOC does not pose a fire or explosion hazard; it remains stable under all conditions of storage, handling and transport. The manner in which UOC is packed in shipping containers and stowed below deck within the ship means that any release of material is very unlikely.

When working around UOC shipping containers, Personal Protective Equipment (PPE) is not required under normal conditions of use. Only basic protections such as hard hats, steel capped boots, gloves and safety glasses are required. If appropriate precautions are taken to minimise exposure when handling, transporting or storing UOC materials, there will be no risk to health.

As UOC has slight chemical toxicity and is weakly radioactive, inhalation and ingestion should be avoided. UOC is toxic if inhaled or swallowed, causing damage to the kidneys, liver and lungs through prolonged or repeated exposure. However the risk of inhalation or ingestion is minimal because UOC is a highly dense material, meaning there is minimal dusting. The toxicity risks from UOC are also lower than other forms of uranium because it is effectively insoluble.

UOC, being principally an alpha emitter, is unable to penetrate through the skin on our bodies. Its low toxicity does not affect the skin nor is there any evidence of negative health effects from skin contact with UOC.

What would be the emergency response in the unlikely event of an incident?

In the unlikely event of an incident, radioactive materials (Class 7) are no different from the other classes of dangerous goods for emergency response purposes. A spill of UOC should be treated the same as an incident involving any other dangerous good/heavy metal concentrate. The most important thing to remember is to remain upwind, and avoid inhalation. In the case of a spill, the following PPE may be required: a Class P2 (particulate) respirator, dust-proof goggles, coveralls and PVC, rubber or cotton gloves. Other than the inhalation hazard, spilled UOC does not pose any immediate danger.

The responsibility for the initial response to any incident involving drummed UOC during international shipment will generally fall with either the ship's crew or the operations staff at the port or terminal. The initial response should always follow that organisation's 'in house' incident response guidelines for dangerous goods. In addition all exporters of uranium are required to create incident response plans in case of an accident during export.

You should first obtain basic information about the situation including the nature and time of incident; the precise location; the quantity and condition of UOC involved; any particular hazards; details of the container and drum numbers; the extent of damage or security breach; the events leading up to the accident; and any actions taken. The appropriate people should be notified including the consignee, the regulatory authority, the competent authorities and the shipping line. Further escalation will depend on the scale and nature of the incident.

See *Chapter 6: Responding to an incident while transporting UOC* for more specific steps to take in the case of an incident during trans-shipment and/or transit. Information for exporters on how to create an Incident Response Action Plan (IRAP) is at *Chapter 7: Incident Response Action Plans*.

Other Resources:

The International Atomic Energy Agency (IAEA) offers resources and online courses in the safe transport of Class 7 radioactive material at the following website: www.class7elearning.com/index.aspx

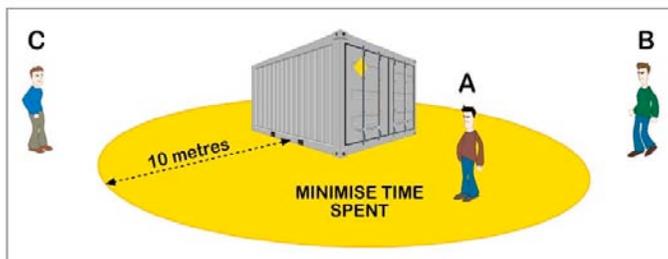


Figure 10:
Risk of radiation from
a sealed container.

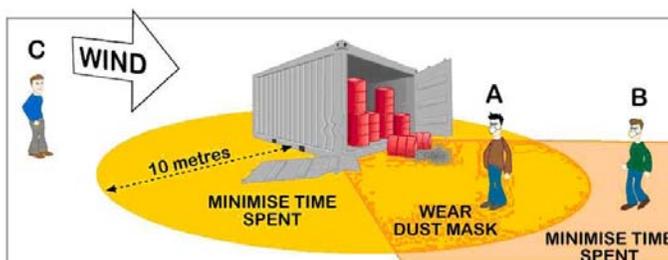


Figure 11:
Risk of radiation from
dust inhalation and
ingestion in an incident
involving UOC spillage.

Chapter 2:

Radiation protection and UOC

Although Uranium Oxide Concentrate (UOC) is only weakly radioactive, radiation protection remains of importance. Generally, radiation doses associated with UOC transport are well below all relevant international limits and guidance levels, and are low in comparison with natural background radiation doses. This document examines the radiation characteristics of UOC in more detail.

There are only two significant ways in which UOC can influence a person's radiation dose: alpha emissions and gamma emissions.

UOC is mainly an alpha emitter (cannot penetrate a sheet of paper, let alone a steel drum), which means that if the material remains in its container it poses no potential alpha dose risk to personnel. The only time personnel might be exposed to alpha radiation from UOC would be in the event of a spill of the material. In this case, the risk can be controlled by using respiratory protection and other personal protective equipment (PPE), and by controlling dust generation (see *Chapter 6: Responding to an incident while transporting UOC* for more information). If UOC is not inhaled or ingested, in all normal transport scenarios, the alpha radiation's contribution to dose levels would be zero.

UOC is a weak, low-energy gamma emitter. When in proximity to containers and drums of UOC, there will be an increase in the gamma dose rate. The levels of gamma dose are well known, and a conservative approach is used to provide a high level of protection during transport. Table 1 below shows the typical radiation dose rates at 1m and 2m from a drum and a container of UOC when shipped. Please note that 0.02 mSv/hr (millisieverts per hour) is equal to 20 µSv/hr (microsieverts per hour), a multiplier of one thousand. These units are often used interchangeably in transport documentation and monitoring instruments.

Due to the radioactive nature of UOC, the gamma radiation dose rates increase over time after it is produced. The increase in the gamma dose rate is due to the decay of the U_{238} (Uranium-238) to Th_{234} (Thorium-234) which is a gamma emitter. The Th_{234} comes into equilibrium with the U_{238} after about two to three months, so the gamma dose rate ceases to increase after this time (Figure 12). To account for this increase in gamma dose rates, UOC producers often use a conservative maximum upper dose rate in their Delivery (Production) Documentation. This dose rate is reported in shipping documents and is also used to calculate the Transport Index (TI), which is used to designate the degree of control that needs to be exercised by the carrier during transportation.

| Description | Contained Activity of U ₂₃₈ (GBq) | Gamma dose rate @ 1 metre (mSv/h) | Gamma dose rate @ 2 metres (mSv/h) | Max Gamma Dose Rate @ surface (mSv/h) | Transport Index |
|-------------|--|-----------------------------------|------------------------------------|---------------------------------------|------------------|
| Drum | 10 | 0.004 [#] | - | 0.02 | 0.4 [#] |
| Container | 440 | 0.02* | 0.01 | 0.06 | 6.0* |

Table 1: Typical radiation dose rates for UOC.

[#] Measured maximum values from actual drums. The ARPANSA Code of Practice for the Safe Transport of Radioactive Substances 2008 also allows the use of a default value of 0.02 mSv/h at one metre from any container - a drum would have a TI of 2 if this default was used.

* Accurate measurements can yield lower dose rates and hence a lower TI for the container (Figure 1).

To put these dose rates in context, they can be compared with both statutory limits and natural background radiation. The occupational and public dose limits for exposure to radiation are 20mSv/year and 1mSv/year (above the natural background radiation) respectively. This would mean that a person would have to spend approximately 1,000 hours within one metre from a container of UOC to reach the occupational limit. During typical transport operations (including loading, trucking and shipping) doses typically remain well under the public dose limit, let alone the occupational limit.

The level of exposure received from transporting UOC is of the same order as that received from natural background radiation. The average person worldwide is exposed to 2.4mSv/year in background radiation from natural sources². The normal radiation range in nature is between 1 and 10mSv/year, with the exact annual dose dependent on location, climate and lifestyle. Dose rates received standing near a container are similar to those received in a modern aircraft at cruising altitude (because there is less atmospheric shielding from cosmic rays). For this reason, personnel involved in the transport of UOC will typically receive a lower dose than that received by international aircrew and some frequent flyers.

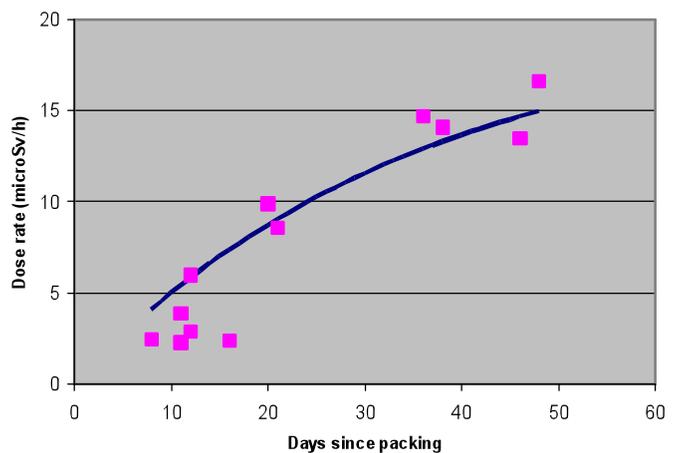


Figure 12: Gamma dose rate measurement next to a container of UOC.

² Sources and effects of ionizing radiation, United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) 2008, http://www.unscear.org/docs/reports/2008/09-86753_Report_2008_Annex_B.pdf

Chapter 3:

Guide to packaging and stowage of shipping containers carrying UOC

Packaging drummed UOC

Uranium Oxide Concentrate (UOC) is packaged in sealed 200-litre steel drums meeting IP-1 industrial package requirements as set out by the International Atomic Energy Agency (IAEA). Each drum has a tight fitting lid which is secured to the drum by means of a steel locking ring and then clamped by a locking ring bolt.

Typical container weights³

Limitations imposed by overseas road regulations play a key role in determining total gross container weights and these will vary depending on final destination. Table 2 outlines the typical weights of shipping containers containing drums of UOC as U_3O_8 for shipment to Canada, China, Europe and the US.

| Description | Destination: Canada, China, Europe (kg) | Destination: US (kg) |
|---------------|--|-------------------------|
| U_3O_8 | 19,100 | 17,750 |
| UOC | 19,200 | 17,850 |
| UOC plus Drum | 21,200 | 18,790 |
| GCW container | 22,500 | 21,200 |

Table 2: Typical container weights for UOC containing U_3O_8 material.

Typical drum weights

Converters also place some limitations on the minimum and maximum weight of drum and product. Converters treat each shipping container as a lot which consists of a quantity of batches each having an equal number of drums. Producers will develop a best fit approach to developing the maximum quantity of drums that ensure alignment with maximum and minimum converter drum weight requirements whilst maintaining compliance with the appropriate road weight limits. Therefore the weight of the drums can vary depending on the converter they are being shipped to, with drum weights being lower for

³ Since the majority of Australian uranium is exported as UOC containing U_3O_8 , it is used as the example in this document. If instead uranium is being shipped as UOC containing UO_2 the drum weights will be significantly less than those for UOC containing U_3O_8 due to its lower specific gravity.

shipments to the US. Table 3 outlines the typical weights of drums containing UOC as U_3O_8 for shipment to Canada, China, Europe and the US.

| Description | Destination: Canada, China, Europe (kg) | Destination: US (kg) |
|---------------|--|-------------------------|
| U_3O_8 | 398 | 370 |
| UOC | 400 | 372 |
| UOC plus Drum | 421 | 393 |

Table 3: Typical UOC drum weights for UOC containing U_3O_8 material.

Drums filled with UOC are stowed securely within 20-foot ISO sea freight containers (or cargo transport units (CTUs)) to international standards using a webbed Kevlar-based strapping system. This is the preferred packaging method and complies with the requirement of the International Maritime Dangerous Goods (IMDG) Code and relevant United Nations (UN) guidelines for packaging of CTUs. Whilst the concept for this method has been formally approved by the Australian Maritime Safety Authority (AMSA), individual approvals based on the requirements of each producer must be obtained from AMSA before shipments can occur.

In accordance with Australian and International Safeguard requirements, the containers are marked and placarded (or the appropriate category of label can be used in place of a placard, as long as its dimensions are the same as a placard). The containers are then inspected and sealed with consecutively numbered C-TPAT (Customs-Trade Partnership against Terrorism) bolt seals fixed to the door of each container. The container doors remain sealed throughout the entire journey from mine site to final overseas point of delivery. The container seals are checked for integrity at all trans-shipment and discharge points.



Figures 13, 14, 15 and 16:
Drums of UOC being
packed into 20-foot ISO
shipping containers



Figure 17:
Placarding required for
containers carrying UOC

Stowage of containers

All containers containing Australian UOC are stowed under deck within the vessel hull. The shipping containers are generally positioned door to door, minimizing the opportunity for the doors to open should some external event trigger a significant impact or force on the containers during ocean transit.



Figures 18, 19 and 20:
Placement of containers
in under deck holds



Figures 21 and 22:
General Cargo is packed
around the Class 7
and on top of
the hatch covers

Chapter 4:

Safety Data Sheet

for drummed UOC as U_3O_8

| | |
|---|--|
| PRODUCT NAME: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U_3O_8 | |
| Safety Data Sheet for: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U_3O_8 | |
| 1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER | |
| Supplier Name | |
| Address | |
| Telephone | |
| 24 hr Emergency | |
| Product Name | Drummed Uranium Oxide Concentrate (UOC) |
| Synonyms | MIXED OXIDES OF URANIUM, TRIURANIUM OCTAOXIDE, U_3O_8 , URANIUM ORE CONCENTRATE, URANYL URANATE |
| Uses | For processing into fuel for use in civilian nuclear power reactors |
| SDS Date | |
| 2. HAZARD IDENTIFICATION | |
| INTERNATIONAL CLASSIFICATION | Class 7 Dangerous Goods (Radioactive material) |
| GHS CLASSIFICATION | Acute Toxicity: Oral: Category 3 Acute Toxicity: Inhalation: Category 3 Specific Target Organ Systemic Toxicity (Repeated Exposure): Category 2 (kidneys or lungs). Aquatic Toxicity (Chronic): Category 4 |
| HAZARD CLASSIFICATION | Classified as hazardous according to the criteria of Safe Work Australia. Classified as Dangerous according to (the Australian Dangerous Goods (ADG) Code. Not classified by the Globally Harmonised System of Classification and Labeling of Chemicals (GHS). |
| SIGNAL WORD | Danger  |
| HAZARD STATEMENT: | Toxic if swallowed. Toxic if inhaled. May cause damage to organs through prolonged or repeated exposure (kidneys or lungs). May cause long lasting harmful effects to aquatic life |
| PREVENTION STATEMENT | Do not breathe dust or fume. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment. Wear respiratory protection. |

PRODUCT NAME: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U₃O₈

RESPONSE STATEMENTS

IF SWALLOWED:
Immediately call a POISON CENTER or doctor/physician.

IF INHALED:
Remove to fresh air and keep at rest in position comfortable for breathing.
Specific treatment is urgent - see first aid instructions

| | | |
|----------------|---------|---|
| HAZARD SYMBOL | T+ | Very toxic. |
| RISK PHRASES | R 26/28 | Very toxic by inhalation and if swallowed. |
| | R33 | Danger of cumulative effects. |
| | R53 | May cause long-term adverse effects in the aquatic environment. |
| SAFETY PHRASES | S20/21 | When using do not eat, drink or smoke, avoid inhaling or ingesting dust. |
| | S45 | In case of accident or if you feel unwell, seek medical advice immediately. |
| | S61 | Avoid release to the environment. Refer to special instructions. |

3. COMPOSITION / INFORMATION ON INGREDIENTS

| Ingredient | EINECS (European Inventory of Existing Commercial Chemical Substances) | CAS No (Chemical Abstracts Service Registry Number) | Content | Classification |
|---|---|---|------------|----------------|
| Drummed uranium oxide concentrate | 215-702-4 | 7440-61-1 or 1317-99-3 | 97 – 99.5% | DG Class 7 |
| Minor impurities including trace metals (Al 0.06%; Ca 0.07%; Fe 0.18%; Zr 0.036%) | Not Applicable | Not Applicable | < 1% | Not Applicable |

4. FIRST AID MEASURES

Eye If material gets into the eyes, hold the eyelids apart and flush the eye continuously with running water. Continue flushing for at least 15 minutes or until advised to stop by the Poisons Information Centre or a doctor.

Inhalation If inhalation occurs, seek medical advice.

Skin Flush all affected areas with running water. Seek medical advice if irritation develops.

Ingestion See medical advice or contact Poisons Information Centre.

Medical Advice Treat symptomatically. (Assess and treat the identified symptoms)

5. FIRE FIGHTING MEASURES

Flammability Non flammable. No fire or explosion hazard exists.

Fire and Explosion Treat as per requirements for surrounding fires.
If UOC material is present in any associated fire event, remain upwind and notify those downwind of the potential inhalation hazard. Evacuate and control access to the area and contact emergency services. Wear personal protective equipment (PPE) appropriate to conditions surrounding the fire.

Extinguishing Non flammable material. Prevent contamination of drains and or waterways, absorbing any runoff using sand or similar absorbent type materials.

HAZCHEM Code 2Z Water fog or fine sprays must be used, there is NO danger of violent reaction or explosion; appropriate breathing apparatus (for fire only) must be worn and the spillage must be contained.

PRODUCT NAME: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U_3O_8

6. ACCIDENTAL RELEASE MEASURES

Spillage Wear PPE as per Section 8 below. Exposure Controls / Personal Protection. Cover spillage with a tarpaulin or moist sand or similar material. For small spills, spray lightly with water to minimise dust, collecting and placing the material into suitable receptacles (eg) drums or containers. For large spills, remove spilled material with mechanical equipment. Do not flush residues into sewers, water ways or drainage systems. Refer to local Competent Authority prior to the removal of collected materials, and decontamination of cleanup equipment. A list of Australian Competent Authorities is available at http://www.arpansa.gov.au/pubs/rps/comp_auth.pdf

7. PACKAGING, STORAGE AND HANDLING

Packaging UOC is packaged to comply with all necessary international standards. This involves the UOC material being packed into sealed 200 litre steel drums meeting IP-1 international packaging standards, each drum having a tight fitting lid, secured by means of a steel locking ring that is clamped by a locking ring bolt. The drums normally contain approximately either 370 kg to 400 kg of UOC depending on delivery location. The drums are stowed securely into 20 foot ISO (International Organisation for Standardisation) shipping containers to withstand the significant G forces expected during road, rail and sea transportation and associated handling operations. The UOC effectively has a double encapsulation or 'wrap' protection of an inner sealed container (drum) within an outer shipping container and this greatly reduces the likelihood of UOC spilling as a result of an incident.

Storage Storage should be undertaken in accordance with the relevant international, domestic, and regional regulations.

Where regular storage occurs, it is good practice to always use the same area within the shipping terminal for the storage of UOC containers to assist personnel to identify, familiarize and remember Class 7 storage locations.

In selecting storage locations select areas to store shipping containers of Class 7 materials away from office, accommodation, workshops, regular and highly trafficked areas.

Segregate from foodstuffs, oxidizing, corrosive, flammable, explosives or other dangerous goods materials.

Handling Specialised drum lifting equipment must be used when loading shipping containers. The strapping method for securing the 200 litre steel drums inside of the 20 foot shipping containers using a Kevlar polyester webbing strap has been approved by the Australian Maritime Safety Authority (AMSA) as the Competent Authority approving load restraints for the transport of Dangerous Goods and Hazardous Materials by road, rail or sea. Packaging processes are audited annually by Maritime Surveyors from AMSA. <http://www.amsa.gov.au/>.

Normal operating procedures involving diligence and due care should be exercised when handling shipping containers of Class 7 UOC material.

As with any general purpose (GP) shipping container, visual observation and checking for evidence of material or moisture discharges from the shipping container should be reported and investigated.

PRODUCT NAME: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U_3O_8



Forklift handling a drum

Drum grab

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

| Exposure Standards | Ingredient | Reference | TWA (8 hour) | | STEL | |
|--------------------|--|-------------------------------------|--------------|-------|------|-------|
| | | | ppm | mg/m3 | ppm | mg/m3 |
| | Uranium (natural), soluble and insoluble compounds | ASCC (Australia) and ACGIH TLV (US) | | 0.2 | | 0.6 |

Biological limit values 3µg/g of kidney tissue (as uranium)

Engineering controls Multiple encapsulation through the utilisation of steel drums securely stowed inside locked and sealed steel shipping containers.

Personal Protective Equipment (PPE) PPE is not required under normal conditions of use. In the case of a spill, the following PPE may be required: a Class P2 (particulate) respirator, dust-proof goggles, coveralls and PVC, rubber or cotton gloves.

The use of radiation badges to monitor exposure is not required for persons handling, storing and transporting drummed UOC in shipping containers. Some monitoring may be required during spill cleanup.



9. PHYSICAL AND CHEMICAL PROPERTIES

| | | | |
|------------------------|----------------------------|---------------------------|---------------|
| Appearance | Dark green to brown powder | Solubility (Water) | Insoluble |
| Odour | Odourless | Specific Gravity | >7 |
| pH | Not Applicable | % Volatiles | Not Available |
| Vapour Pressure | Nearly 0 @ 20 degrees C | Flammability | Non Flammable |

| PRODUCT NAME: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U₃O₈ | | | |
|---|--|---------------------------|----------------|
| Vapour Density | Not Applicable | Flash Point | Not Applicable |
| Boiling Point | Not Applicable | Upper Explosion Limit | Not Applicable |
| Melting Point | U ₃ O ₈ decomposes to UO ₂ at 1300C, which then melts at 2878 degrees C | Lower Explosion Limit | Not Applicable |
| Evaporation Rate | Not Applicable | Odour Threshold | Not Applicable |
| Decomposition Temperature | 1300 degrees C | Viscosity | Not Applicable |
| Partition Coefficient | 63 to 63,000 ml/g @ pH 7 | Auto Ignition Temperature | Non Flammable |

10. STABILITY AND REACTIVITY

| | |
|------------------------|---|
| Stability | Stable under all conditions of storage, handling and transport. |
| Conditions to avoid | No reported incompatibilities. |
| Materials to avoid | Avoid storage or transporting adjacent to volatile, corrosive or oxidizing materials. |
| Decomposition Products | Decomposes to UO ₂ at 1300 degrees C. |
| Hazardous reactions | Polymerization will not occur. |

11. TOXICOLOGICAL INFORMATION

| | |
|--|---|
| Summary | The health effects associated with ingestion and skin exposure to uranium appear to be solely chemical in nature, and not due to its radioactivity. There may be a slight radiological risk from very prolonged inhalation. Tolerable intakes are limited by chemical toxicity for ingestion. |
| Acute toxicity | Uranium is primarily a nephrotoxin (a kidney poison). Studies indicate that long term effects of exposure to uranium by ingestion may result in kidney impairment due to its toxicological effects as a heavy metal. Kathren and Burklin (2008) estimated, that for soluble uranium salts, an acute, oral LD ₅₀ of 70 mg/kg body weight (which is equivalent to 5 g for a 70 kg human). If adopted, this LD ₅₀ would result in a classification of toxicity category 3 for soluble uranium salts under the GHS equivalent to a toxic (T) classification under the current SafeWork Australia Classification. Kathren and Burklin further state that insoluble uranium compounds including U ₃ O ₈ are practically non-toxic. Hence the LD ₅₀ for insoluble salts would be much more than that for soluble salts. |
| Skin corrosion/irritation | No evidence of erythema or other effects on the skin. |
| Serious eye damage/irritation | Low to moderate irritant. Exposure may result in irritation, pain and redness. |
| Respiratory or skin sensitisation | No evidence of sensitization by respiratory or dermal routes. |
| Germ cell mutagenicity | There is some evidence of genetic effects from radiation from UOC in animal studies, however there has been no evidence reported in human studies. |
| Carcinogenicity | Radiation dose from prolonged exposure to UOC dust could possibly lead to increased risk of cancer. |
| Reproductive toxicity | There is limited available data on the reproductive toxicity in humans. |
| Aspiration hazard | Material is insoluble and may be retained within the lungs. |

| PRODUCT NAME: Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U₃O₈ | | | | |
|---|--|---|------------|--|
| Ingredient Name | CAS No | NTP | IARC | OSHA |
| Uranium Oxide is not reported as being a carcinogenic material by NTP, IARC or OSHA. | 7440-61-1 (metal) or 1317-99-3 (U ₃ O ₈) | Not listed | Not listed | Not listed |
| NIOSH classifies insoluble uranium compounds as potential occupational carcinogens, but states that the potential for cancer is a result of alpha-emitting properties and radioactive decay products (e.g., radon). | | | | |
| 12. ECOLOGICAL INFORMATION | | | | |
| Eco Toxicity | Green algae LOEC 70 – 170 µg/L; mussels EC ₅₀ 380 – 600 µg/L (Warne et al. 2009) | | | |
| Persistence / Degradability | Sediments act as sink for insoluble uranium compounds. | | | |
| Bio accumulative potential | Bioaccumulation in aquatic species (fish) is low. No significant translocation of uranium from soils to above ground parts of plants observed. | | | |
| Mobility | Mobility depends upon uranium being in a soluble form [noting that uranium as U ₃ O ₈ is insoluble in water]. | | | |
| 13. DISPOSAL CONSIDERATIONS | | | | |
| Waste disposal | Do not dispose of material, other than with the instructions and approval of the relevant Competent Authority. < http://www.arpana.gov.au/pubs/rps/comp_auth.pdf > | | | |
| Legislation | Consult with the local Competent Authority. < http://www.arpana.gov.au/pubs/rps/comp_auth.pdf > | | | |
| 14. TRANSPORT INFORMATION | | | | |
|  | |  | |  |
| ROAD RAIL AND SEA (ADGR / RID / US DOT / TDG – IMDG / IMO) | | | | |
| Proper shipping name | UN2912 Class 7 Radioactive Material Low Specific Activity (LSA-I non fissile or fissile excepted) | | | |
| Physical Form | Dry Powder (Uranium Oxide Concentrate) | | | |
| Chemical Form | Uranium Ore Concentrate as Uranium Oxide U ₃ O ₈ | | | |
|  | Name of each radionuclide | Natural Uranium (LSA) | | |
| | Category of Packages | III Yellow | | |
| | Maximum Activity | 440 Giga Becquerels | | |
| | Transport Index: | 4.5 | | |
| | Subsidiary risk(s) | None allocated | | |
| | Packing Group | Class 7 materials have no packing groups under any of the Codes | | |

PRODUCT NAME: **Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U₃O₈**

15. REGULATORY INFORMATION

UNITED STATES

| | | | | | |
|---|---------------------|---|--|--|--|
| HMIS (Hazardous Material Identification System) | Health | 2 | NFPA (National Fire Protection Association) | | |
| | Flammability | 0 | | | |
| | Physical Hazard | 0 | | | |
| | Personal Protection | | | | |

Reference: ILPI 2010.

16. OTHER INFORMATION

| Additional information – Abbreviations and References | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ADGR | Australian Dangerous Goods Regulations |
| AMSA | Australian Maritime Safety Authority |
| ASCC | Australian Safety and Compensation Council |
| CAS No. | Chemical Abstract Service number - used to uniquely identify chemical compounds. |
| DG | Dangerous Goods |
| EC ₅₀ | Concentration at which 50% of the maximum effect is observed |
| EINECS | European Inventory of Existing Chemical Substances |
| GHS | Globally Harmonized System of classification and labeling of chemical materials |
| GP | General Purpose (twenty foot shipping container) |
| HAZCHEM ZZ | Water fog or fine sprays must be used, there is NO danger of violent reaction or explosion; appropriate breathing apparatus (for fire only) must be worn and the spillage must be contained. |
| HMIS | Hazardous Materials Identification System |
| HSIS | Hazardous Substances Information System |
| IARC | International Agency for Research on Cancer. |
| IDLH | Immediately dangerous to life and health |
| IMDG | International Maritime Dangerous Goods (Code) |
| IMO | International Maritime Organisation |
| LD ₅₀ | LD stands for "Lethal Dose". Oral LD ₅₀ is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. The LD ₅₀ is one way to measure the short-term poisoning potential (acute toxicity) of a material. |
| LSA-1 | Low Specific Activity (rating of radiation risk) |
| LOEC | Lowest Observable Effect Concentration |
| mg/m ³ | Milligrams per cubic metre. |
| ml/g | Milliliters per gram |

PRODUCT NAME: **Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U₃O₈**

| Additional information – Abbreviations and References | |
|---|--|
| NFPA | National Fire Protection Association (United States) |
| NTP | National Toxicology Program (US) National Institute of Environmental Health Sciences. |
| OSHA | Occupational Safety and Health Administration |
| pH | relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline) |
| PPE | Personal Protective Equipment |
| ppm | Parts Per Million |
| PVC | Poly vinyl chloride |
| RID | Regulations concerning the International Transport of Dangerous Goods by Rail (European law) |
| STEL | Short Term Exposure Limit |
| STOST | Specific Target Organ Systemic Toxicity (single exposure) |
| TDG | Transportation of Dangerous Goods Act (Canada) |
| TLV | Threshold Limit Value |
| TWA | Time Weighted Average (Exposure Standard) |
| µg | microgram |
| UN | United Nations |
| UOC | Uranium Oxide Concentrates |
| USDOT | United States Department of Transport |

| List of references used in this SDS | |
|---|--|
| 1. Commonwealth of Australia 2007. <i>Australian Code for the Transport of Dangerous goods by Road and Rail (ADG Code)</i> , 7 th ed. National Transport Commission, Canberra. | 2. Health Council of the Netherlands, 2001. Health risks of exposure to depleted uranium. Publication no. 2001/13E. Revised version 5 February 2002. |
| 3. ILPI 2010. Hazardous Materials Information System. www.ilpi.com/msds/ref/hmis/html Viewed 11/06/2010. | 4. International Agency for Research on Cancer (www.iarc.fr) Health Risk of Depleted |
| 5. Kathren, RL and Burklin, RK. 2008. Acute chemical toxicity of uranium. <i>Health Physics</i> 94: 170 – 179. | 6. Littleton, B, 2006. Depleted Uranium – Technical Brief US Environmental Protection Agency. www.epa.gov/rpdweb00/docs/402-r-06-011 |
| 7. National Institute for Occupational Safety and health (NIOSH) – Pocket Guide to Chemical Hazards | 8. National Toxicology Program, 2005. 11 th Report on Carcinogens http://ntp.niehs.nih.gov/ Viewed 11/06/2010 |
| 9. Safe Work Australia not dated. Hazardous Substances Information System – Guidance Material for Hazard Classifications. http://hsis.asc.gov.au/SearchHS.aspx Viewed 11/06/2010 | 10. US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, 1999. Toxicology Profile for Uranium. Viewed 11/06/2010. |
| 11. Warne M St J, Langdon K, Sunderam RIM. 2009. Updating the Australasian Ecotoxicology Database for Metals. CSIRO Land and Water, Science Report 53/09. Adelaide | |

PRODUCT NAME: **Drummed Uranium Oxide Concentrate (UOC) in the chemical form of U_3O_8**

Report Status

This document serves as a model for a Supplier's Safety Data Sheet (SDS). It is not intended for direct use by industry.

It is based on information concerning the product which has been provided by industry or obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the Supplier.

Whilst industry has taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, industry accepts no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

The information contained in this Supplier's Safety Data Sheet (SDS) is provided to assist in evaluating the safety characteristics of the (product/mineral/substance) in question. The information is provided in good faith, but a risk assessment for the proposed use of the (product/mineral/substance) should be undertaken prior to that use. All persons coming into contact with the (product/mineral/substance) should be made aware of the contents of this SDS.

End of Report

Chapter 5:

Documentation required to transit Class 7 cargo through ports

Port authorities require shippers to produce certain documentation in order to gain approval to transit Class 7 goods through the port. Documents which the shipper (through the Carrier's local agent) might be required to provide to the port authority include:

1. Dangerous Goods Declaration
2. Radioactive Monitoring Record
3. Export License
4. Import License
5. Transport documents
6. Safety Certificate
7. Transit licenses and or permit approvals for specific ports in some countries

These documents may be required some time in advance. This guidance document explains the equivalent Australian documentation.

| Requested document | Australian-equivalent document | Comments |
|----------------------------------|---|--|
| 1. Dangerous Goods Declaration | Multimodal Dangerous Goods form (1 per shipping container) | This form must be provided to the Ship Master, and to the Australian Maritime Safety Authority (AMSA), on request. |
| 2. Radioactive Monitoring Record | Delivery (Production) Documentation This document essentially comprises the cargo manifest | This document contains details relating to dose rates per container in the form of a combined Summarised Delivery, Container Packing List and Radiation Dose Rate Report. A default radiation dose rate is used to represent the maximum possible radiation level. Refer to <i>DOC B: Radiation protection and UOC</i> for more details |
| 3. Export License | RET Export Approval letter | This letter is issued by the Department of Resources, Energy and Tourism (RET). It confirms that the purpose of shipment is to perform existing uranium sales contracts, and that it has received a safeguards clearance from the Australian Safeguards and NonProliferation Office (ASNO). It confirms that the cargo is being shipped under approved conditional uranium export permissions, issued by the Minister for Resources and Energy, granted to approved facilities in the USA, Canada, France or China in accordance with the Consignor's export permission. |
| 4. Import License | Signed ASO110 (Application to Transfer UOC Internationally) form with YC reference details | This form is issued by ASNO. It verifies that the cargo has been approved for transfer from Australia into the country of the Consignee under the bilateral safeguards agreement between Australia and that country. The approval process includes links to the RET export permission approval process. |

| Requested document | Australian-equivalent document | Comments |
|--|---|---|
| 5. Transport documents | <p>i Supplement to the International Maritime Dangerous Goods (IMDG) Code 35-1</p> <p>ii Container Indemnity and Cleanliness form</p> <p>iii Certificate of Origin</p> <p>iv Certificate of Insurance</p> | <p>i. The Supplement to the IMDG Code 35-10 addresses the procedures for a ship's crew responding in the event of spillages, or the need for fire suppression associated with radioactive materials.</p> <p>ii. This form provides documentary evidence that each shipping container meets compliance requirements for 'Shipper Owned Containers' (SOC) with the 'Convention for Safe Containers' (CSC) and conformance with container packing requirements of the United States Customs and Border Protection, Customs-Trade Partnership Against Terrorism (C-TPAT). The form also addresses requirements under paragraph 508 and 509 regarding drum and container cleanliness and that all drums in the shipping container meet the industrial packages (IP-1) requirements as per paragraph 621 of the IAEA Regulations (TS-R-1 2005).</p> <p>iii This certificate provides a statement that the goods were produced in Australia and that they meet strict international safeguards and other export conditions.</p> <p>iv This certificate covers loss and damage to the cargo during transport.</p> |
| 6. Health, Safety, Environment and Community information sheet | Safety data sheet (SDS) for drummed UOC | <p>The SDS provides hazard identification information on the composition of the material, first aid, fire fighting and accidental release measures. It also includes information relating to packing, handling, storage, exposure controls, personal protective equipment requirements, details about the physical and chemical properties of the material, details about its stability and reactivity, toxicological and ecological information, disposal considerations and transport and regulatory information. The document complies with current European Union requirements to meet Global Harmonised Standards</p> <p>A sample SDS can be found at <i>Chapter 4: Safety Data Sheet for drummed UOC as U₃O₈</i>.</p> |
| 7. Transit licenses and or permit approvals for specific ports in some countries | Forms and approval processes are country specific. | <p>Currently Belgium, Holland, Morocco, and New Zealand have requirements whereby long term transit licenses are required.</p> <p>New Zealand and Hong Kong require individual approvals for each transit.</p> <p>During the last several years South African requirements to process nuclear vessel licenses has made transit of South African ports impractical.</p> |

Chapter 6: Responding to an incident while transporting UOC

Summary

For emergency response purposes, Class 7 radioactive materials are no different from the other classes of dangerous goods. As for all dangerous goods, hazards are communicated by marking, labelling, placarding and documentation. This assists identification of the possible hazards in the unlikely event of an accident. Because of the low level of radiation per unit mass, UOC is classified as 'Low Specific Activity' LSA-1 material. The strict packaging requirements mean that any radiation exposure from the transport and handling of processed UOC is minimised. The UOC effectively has double encapsulation or 'wrap' protection, consisting of an inner sealed container (the drum) within an outer shipping container. This greatly reduces the likelihood of there being an incident involving a spillage of the material.

The responsibility for the initial response to any incident involving drummed UOC during international shipment will generally fall with either the ship's crew or the operations staff at the port or terminal. The initial response should always follow that organisation's 'in house' incident response guidelines for dangerous goods. In addition all exporters of uranium are required to create incident response plans in case of an accident during export.

In all situations, irrespective of size or scale, details of the incident must be reported to the consignor of the cargo and to the local Competent Authority. The Competent Authority may then call upon the local radiation management and protection agencies for assistance as deemed necessary.

A list of Australian Competent Authorities can be found at *Chapter 9: List of Australian Competent Authorities*, and at the following website:

http://www.arpansa.gov.au/pubs/rps/comp_auth.pdf

A list of international Competent Authorities can be found here:

<http://www-ns.iaea.org/downloads/rw/transport-safety/transport-safety-nca-list.pdf>

Details of the contents of each shipping container should be outlined in a detailed delivery manifest and the Safety Data Sheet (SDS) which contains information about UOC. These documents are provided to the ships crew and are available for each port and terminals through the local shipping line representative. A sample SDS can be found at *Chapter 4: Safety Data Sheet for drummed UOC as U₃O₈*.



Uranium Oxide Concentrate

Uranium is a naturally occurring, weakly radioactive element which is widely distributed through the earth's crust, rocks, soils and waterways. Traces of uranium also occur in foods and the human body.

Uranium is mined and processed into uranium oxide concentrate (UOC), also referred to as uranium ore concentrate or yellow cake, in the form of U_3O_8 or UO_4 . UOC is both chemically and physically stable, and can not itself sustain a nuclear chain reaction.

| | |
|----------------------|---|
| Chemical Name | Uranium Ore Concentrate as Uranium Oxide U_3O_8 |
| Proper Shipping Name | Radioactive Material, Low Specific Activity (LSA-1) Non-Fissile or Fissile – Excepted |
| Class Number | 7 (Class 7 Radioactive Material) |
| UN Number | UN2912 Class 7 Schedule No: 5, LSA-1 |
| Common Name | UOC, yellow cake, U_3O_8 |

Packaging of drummed UOC

Australian UOC is packaged to comply with, and generally to exceed, all applicable national and international requirements. The method used by Australian producers is approved by Australian Maritime Safety Authority (AMSA). UOC is packaged in sealed 200 litre steel drums meeting IP-1 industrial package standards. Each drum has a tight fitting lid which is secured to the drum with a steel locking ring that is clamped by a locking ring bolt. The drums are marked and labelled, and then stowed securely within 20-foot International Organization for Standardisation (ISO) sea freight containers (or cargo transport units (CTUs)) to international standards using a webbed Kevlar-based strapping system to withstand the G-forces expected during road, rail and sea transportation and associated handling operations. This arrangement for securing the drums in the CTU is approved by AMSA for sea transport. The containers are marked and placarded or labelled, and then inspected and

Figure 23 (left): typical BHP Billiton (Olympic Dam) or ERA (Ranger) UOC,

Figure 24 (centre): typical Heathgate (Beverley) UOC drums without lids showing the contents.

Figure 25 (right): the tight fitting lid secured to the drum with a steel locking ring clamped by a locking ring bolt.



Figures 26, 27, 28 and 29 Drums of UOC being stowed into 20-foot ISO shipping containers.

sealed with consecutively numbered C-TPAT (Customs-Trade Partnership against Terrorism) bolt-type seals fixed to the door of each container. The containers remain sealed throughout the journey from mine site to final point of delivery. The seals are checked for integrity at all trans-shipment and discharge points. Further information about the packaging of UOC can be found in *Chapter 3: Guide to packaging and stowage of shipping containers carrying UOC*.



Label - Category III -Yellow



Mark - UN Number



Mark - Marine Pollutant



Placard -
Radioactive Class 7 Good

General incident response

In the event of an incident, stay calm. Remember that UOC remains stable under all conditions of storage, handling and transport, and does not pose a fire or explosion hazard. If you are one of the first people involved at an incident involving UOC, the effectiveness of your initial response and the support you receive will depend on how well you assess the situation.

Types of incident

There are three likely situations that may require some form of incident response action during the transport, handling or storage of UOC.

- Type 1 - an incident that does NOT involve a leakage or spillage of UOC;
- Type 2 - an incident involving the leakage or spillage of UOC; or
- Type 3 - an incident involving any unlawful interruption to the transportation of UOC, or other unplanned delay.

Reporting an incident

If an incident occurs, determine the type of incident you are dealing with (using the information above). Gather facts on what has happened and make an initial assessment prior to calling for assistance. The following information should be documented:

- Nature and time of incident;
- Precise location;
- Quantity and condition of UOC involved;
- Any particular hazards present;
- Details of container number, drum numbers involved;
- Extent of damage or security breach;
- Sequence of events leading to the incident;
- Action taken so far; and
- Notifications to consignee, regulatory authority, competent authorities, shipping line.

Each service provider will have their own incident response plan and procedure to respond to an incident involving UOC. Any incident response must be carried out in accordance with the plan and procedures of the relevant service provider.

The Shippers Declaration for Radioactive Materials will contain the consignor's company contact details. The Multimodal Dangerous Goods Form lists the 24-hour contact number for the shipper, consignor and sender of the UOC. This number is required for all modes of transport.

What would be the emergency response in an incident involving a spillage of UOC?

Type 2 incidents involve the leakage or spillage of UOC. The suggested response to an incident involving a spillage of UOC is similar to that required for an incident involving any other dangerous good. However, an additional requirement is to ensure that any actual or potential radiation exposure is minimised.

In the event of a spill, the most important things to remember are to remain upwind and avoid inhalation. Other than the inhalation hazard, spilled UOC does not pose any immediate danger. While Personal Protective Equipment (PPE) such as hard hats, steel capped boots, gloves and safety glasses are all that is required under normal conditions, in the case of a spill, the following PPE may be required: a Class P2 (particulate) respirator, dust-proof goggles, coveralls and PVC, rubber or cotton gloves.

An effective incident response involves identifying and cleaning up the spillage to prevent an elevation of radiation levels. Following cleanup, radiation levels will be independently monitored and verified to the satisfaction of the relevant competent authority.

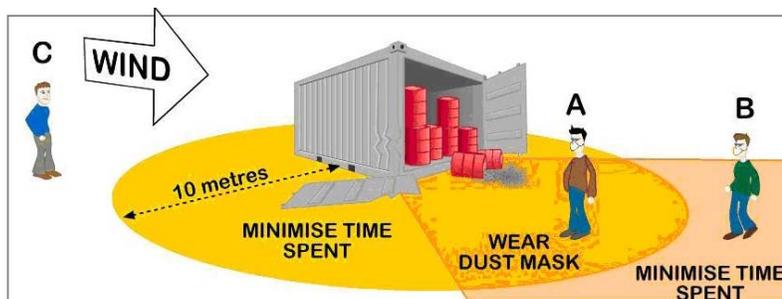
Spillages during trans-shipment

In the case of a spillage during trans-shipment, the release or leakage of any UOC material should be treated as per any other dangerous goods or heavy metal concentrate in accordance with the relevant port or terminal operator's incident response procedures. The responsibility for the initial response will generally lay with the terminal operator. Things to note are:

- The first priority is to rescue any injured personnel;
- Non-critical personnel should be excluded from the area;
- The spilt material should be contained (covered to prevent dusting, bunding of area to reduce washdown);
- Plant, equipment and personnel being excluded from accessing the incident area;
- Basic PPE, e.g. respirator, goggles, gloves, disposable overalls) provide all the necessary protection required for responder safety;
- Clean up will vary according to the scale of the spill but could be as easy as requiring manual collection of spilt material; and
- Regulators (i.e. the local Competent Authority) and the consignor **MUST** be informed of any incident involving a spillage of material.

Depending on the scale of the incident, escalation following assessment will follow local incident response processes and is likely to involve local health protection officers (who provide the radiation monitoring capability) and possibly local fire service personnel who would be involved in the physical recovery of the spilt material.

Figure 30:
Risk of radiation from
dust inhalation and
ingestion in an incident
involving UOC spillage



- A: Wear a dust mask and minimise time spent in close proximity.
B: Wear a dust mask and minimise time spent in close proximity.
C: No dust mask required.

Spillages in transit or whilst at sea

The likelihood of a spillage while in transit or at sea is very low due to the strict packaging and packing requirements. Furthermore, all containers containing Australian UOC are stowed under deck in the vessel. The shipping containers are generally positioned door to door, which minimises the opportunity for the doors to open should some external event trigger a significant impact or force on the containers.

The International Maritime Dangerous Goods (IMDG) Code describes the emergency response procedures for an incident involving dangerous goods, including radioactive materials, at sea. The Ship's Master and crew are the emergency services and medical team for every situation on board once disconnected from land. All personnel working on ships involved in shipping Class 7 materials are fully trained to meet the requirements of the International Convention for the Safety of Life at Sea (SOLAS) 1974, and the International Convention for the Prevention of Pollution from Ships 1973 (MARPOL) and its 1978 Protocol, as amended.

In the unlikely event of a spillage the crew should invoke actions in accordance with the Supplement to the IMDG Code 35-10 **S-S Radioactive Material** (Attachment A). The actions to be taken in case of a fire are described in **F-I Radioactive Material** (Attachment B). Copies of the Spillage Schedule are included with the delivery documentation provided by the consignor to the shipping line.

Medical advice for all dangerous goods is outlined in the Medical First Aid Guide (MFA) which is also contained in the Supplement to the IMDG Code 35-10. This guide will be followed by the Ship's Master and crew in order to effectively and safely respond to any incident.

Security

It is important to maintain the security of the UOC at all times. In particular, it should be ensured that:

- Every person engaged in the handling of dangerous goods exercises reasonable care to avoid damage to packages, unit loads and cargo transport units;
- While dangerous goods are being handled, precautions are taken to prevent unauthorised access to handling areas; and
- If there is any loss of containment/control of dangerous goods, every practical step is taken to minimize risks to persons and adverse effects to the environment.

Contact details

The Multimodal Dangerous Goods Form lists the 24-hour contact number for the shipper, consignor (sender) of the UOC, the consignee (receiver) details together with details about the relevant Incident Response Action Plan (IRAP), together with telephone contact details to activate the IRAP.

The Competent Authority of each state and territory in Australia (see http://www.arpansa.gov.au/pubs/rps/comp_auth.pdf)

and elsewhere throughout the world (see <http://www-ns.iaea.org/downloads/rw/transport-safety/transport-safety-nca-list.pdf>)

should also be contacted in the case of a radiological emergency.

References

International Maritime Dangerous Goods (IMDG) Code 35-10

Supplement to the IMDG Code 35-10

<http://www.imo.org/Publications/IMDGCode/Pages/Default.aspx>

IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1)

<http://www-ns.iaea.org/tech-areas/radiation-safety/transport.asp?s=3&l=23>

or <http://www.iaea.org>

Class 7 e-learning – Training for transport of radioactive materials

<http://www.class7elearning.com/index.aspx>.

Attachment A – The EmS Guide

Note: The following data relates to the transport of all different types of radioactive material, therefore some of the precautions outlined are not applicable to the transport of UOC. In particular UOC does not generate or release any gas or vapours, so some of these requirements do not apply. As all Australian UOC transported by sea is stowed under deck, some of these requirements are also unlikely to apply. If a spill does occur, an initial containment of the spilt material should be carried out using suitable personal protective equipment (PPE), rather than spraying the spilt material overboard.

SPILL SCHEDULE Sierra

**S-S
RADIOACTIVE MATERIAL**

| | | | | | |
|--|---|---|--|--|---|
| <p>General comments</p> | <p>Evacuate compartment or downwind area of non-essential personnel. Provide respiratory protection to personnel in downwind area. For ships carrying radiation monitoring equipment, measure radiation levels. In this case, access the extent of contamination and resultant radiation level of the package, the adjacent areas and, if necessary, all other material which has been carried in the conveyance. Define a zone for restricted entry. Personnel should not enter this zone without suitable protective clothing and self-contained breathing apparatus. Limit entry of personnel to the restricted zone for the shortest time possible. Cover liquid spill with inert absorbent materials, if available. Cover powder spills with plastic sheet or tarpaulin to minimize spread. If exposure of personnel is suspected, clean body and hair with warm water and soap; discharge resultant washings directly overboard. Record the names of potentially exposed persons. Ensure medical examination of these persons after reaching any medical staff. Emergency procedures, if established for the ship or the specific cargo by relevant authorities or the shipper, should be followed. For ships carrying radiation monitoring equipment, continue monitoring the radiation levels. Radio for expert ADVICE.</p> | | | | |
| <p>Spillage on deck</p> | <table border="1"> <tr> <td data-bbox="501 721 593 791"> <p>Packages (small spillage)</p> </td> <td data-bbox="593 721 1166 791"> <p>Wash spillages overboard with copious quantities of water. Keep clear of effluent. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority.</p> </td> </tr> <tr> <td data-bbox="501 791 593 932"> <p>Cargo Transport Units (large spillage)</p> </td> <td data-bbox="593 791 1166 932"> <p>Let released gas escape. Keep clear. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours (water curtain). Absorb liquid spillage, where practicable, using absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Wash residues of liquids or solids overboard with copious quantities of water (use spray nozzles). Do not allow water to enter receptacles.</p> </td> </tr> </table> | <p>Packages (small spillage)</p> | <p>Wash spillages overboard with copious quantities of water. Keep clear of effluent. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority.</p> | <p>Cargo Transport Units (large spillage)</p> | <p>Let released gas escape. Keep clear. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours (water curtain). Absorb liquid spillage, where practicable, using absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Wash residues of liquids or solids overboard with copious quantities of water (use spray nozzles). Do not allow water to enter receptacles.</p> |
| <p>Packages (small spillage)</p> | <p>Wash spillages overboard with copious quantities of water. Keep clear of effluent. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority.</p> | | | | |
| <p>Cargo Transport Units (large spillage)</p> | <p>Let released gas escape. Keep clear. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours (water curtain). Absorb liquid spillage, where practicable, using absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Wash residues of liquids or solids overboard with copious quantities of water (use spray nozzles). Do not allow water to enter receptacles.</p> | | | | |
| <p>Spillage under deck</p> | <table border="1"> <tr> <td data-bbox="501 932 593 1125"> <p>Packages (small spillage)</p> </td> <td data-bbox="593 932 1166 1125"> <p>Provide adequate ventilation. Let released gas escape, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours or fumes entering occupied areas of the ship, e.g., living quarters, machinery spaces, working areas. Keep solids dry. Absorb liquid spillage, where practicable, using inert absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Keep working period of emergency team in space as short as possible.</p> </td> </tr> <tr> <td data-bbox="501 1125 593 1230"> <p>Cargo Transport Units (large spillage)</p> </td> <td data-bbox="593 1125 1166 1230"> <p>Do not enter space. Radio for expert ADVICE. <i>If liquid, or vapour is developing:</i> Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours entering occupied areas of the ship, e.g., living quarters, machinery spaces, working areas. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours evolving from the hold (water curtain).</p> </td> </tr> </table> | <p>Packages (small spillage)</p> | <p>Provide adequate ventilation. Let released gas escape, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours or fumes entering occupied areas of the ship, e.g., living quarters, machinery spaces, working areas. Keep solids dry. Absorb liquid spillage, where practicable, using inert absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Keep working period of emergency team in space as short as possible.</p> | <p>Cargo Transport Units (large spillage)</p> | <p>Do not enter space. Radio for expert ADVICE. <i>If liquid, or vapour is developing:</i> Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours entering occupied areas of the ship, e.g., living quarters, machinery spaces, working areas. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours evolving from the hold (water curtain).</p> |
| <p>Packages (small spillage)</p> | <p>Provide adequate ventilation. Let released gas escape, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours or fumes entering occupied areas of the ship, e.g., living quarters, machinery spaces, working areas. Keep solids dry. Absorb liquid spillage, where practicable, using inert absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Keep working period of emergency team in space as short as possible.</p> | | | | |
| <p>Cargo Transport Units (large spillage)</p> | <p>Do not enter space. Radio for expert ADVICE. <i>If liquid, or vapour is developing:</i> Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours entering occupied areas of the ship, e.g., living quarters, machinery spaces, working areas. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours evolving from the hold (water curtain).</p> | | | | |
| <p>Special cases: UN 2977, UN 2978</p> | <p>Avoid contact, even when wearing protective clothing. Keep clear of evolving vapours. Even short time inhalation of small quantities of vapour can cause breathing difficulties.</p> | | | | |

| | |
|---|---|
| Special cases: | |
| UN 2977, UN 2978 | <p>Avoid contact, even when wearing protective clothing. Keep clear of evolving vapours. Even short time inhalation of small quantities of vapour can cause breathing difficulties.</p> <p>Bear in mind that gases are heavier than air. Measure should be taken to prevent leaking gasses from penetrating into any other part of the ship.</p> <p>Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive and toxic vapours by using water spray to drive vapours away.</p> <p>Do not enter space without protective equipment. Keep clear. Radio for expert ADVICE.</p> |
| UN 2919, UN 3331 | <p>For radioactive material, <i>transported under special arrangement</i>, use special precautions, operational controls or emergency procedures as specifically designated by the competent authorities in their approval certificates and declared by the shipper in its transport documents.</p> |
| Subsidiary labels class 4.2 or class 4.3 | <p>These are pyrophoric substances, water will ignite the material. DO NOT USE WATER. Radio for expert ADVICE.</p> |
| Restowing of packages | |
| UN 2977, UN 3324, UN 3325, UN 3326, | <p>Check package labels and transport documents to determine whether packages contain fissile material.</p> |

FIRE SCHEDULE India

F-I
RADIOACTIVE MATERIAL

| | | |
|--|------------------------------|--|
| General comments | | <p>Evacuate compartment or downwind area of non-essential personnel. Do not touch damaged packages. In cases of suspected radioactive contamination, limit entry of firefighters for the shortest time possible. For ships carrying radiation monitoring equipment, measure radiation levels. Radio for expert ADVICE. After the fire has been extinguished, clean ship's surface with copious quantities of water. Decontaminate firefighters before protective clothing is removed. Isolate potentially contaminated clothing and equipment. If exposure of personnel is suspected, clean body and hair with warm water and soap; discharge resultant washings directly overboard. Record the names of potentially exposed persons. Ensure medical examination of these persons after reaching any medical staff. For ships carrying radiation monitoring equipment, continue monitoring of radiation levels after fire is extinguished.</p> |
| Cargo on fire on deck | Packages | Create water spray from as many hoses as possible. |
| | Cargo Transport Units | Create water spray from as many hoses as possible. Cool burning transport units and nearby cargo exposed to the fire with copious quantities of water. |
| Cargo on fire under deck | | Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water. |
| Cargo exposed to fire | | If practicable, remove or jettison packages which are likely to be involved in the fire. Otherwise, cool for several hours using copious quantities of water. |
| Special cases: | | |
| UN 2977, UN 2978 | | Chemical hazard greatly exceeds radiation hazard. Material reacts with moisture to form toxic and corrosive gas. The run-off may be corrosive. Keep clear. Exposed cargoes may explode in a fire. Create water spray. Leak may be evident by visible and irritating vapours. Released vapours may also react violently with hydrocarbons (fuel). |
| UN 3332, UN 3333 | | If the source capsule is identified as being out of its packaging, do not touch. Stay away, minimize exposure to radiation by limiting time near material and by maximizing distance. Radio for expert ADVICE. |
| Subsidiary label class 4.2 or class 4.3 | | All radioactive material with subsidiary risk label 4.2 or 4.3 affixed (e.g. pyrophoric uranium or thorium metal): Radio for expert ADVICE. On deck: Do not use water onto the material. Cool nearby cargo with copious quantities of water, although the fire could intensify for a short period. Do not spray small quantities of water onto the fire, use copious quantities of water. Under deck: Stop ventilation and close hatches. The fixed gas fire-extinguishing system should be used. If this is not available, do not use water onto the material in enclosed spaces under deck. With open hatches, cool nearby cargo with copious quantities, although the fire could intensify for a short period. Do not spray small quantities of water onto the fire, use copious quantities of water only. |

Chapter 7. Guidance on the creation of incident response action plans

Incident response action plans (IRAP) are a regular requirement for safely and securely managing the road and/or rail transport of any dangerous good or hazardous material. An IRAP will help those involved in the transport of such materials to regain control in the event of an emergency.

An unplanned event can cause us to lose control of the process, creating some form of emergency. An emergency is “an event for which immediate action is necessary”. The time taken to react to an emergency and the manner in which we respond affects how efficiently we regain control of the process. If we fail to regain control of the process then the emergency will escalate into an incident and require further management.

An effective IRAP for the transport of UOC will focus on developing the procedures required to minimise harm to the health and safety of people or the environment in an emergency situation. Procedures can include assessment, corrective actions, response to community concern and the implementation of appropriate incident response measures.

How to maintain control of a process

The procedures, corrective actions and risk assessments associated with ensuring processes remain under control in day-to-day operations are generally managed at the operational level, as is the response to an emergency event. The processes associated with regaining control of a process in the event of an emergency are generally determined by top-level management.

IRAPs, transport and security

The safeguards and security requirements of the Australian Safeguards and Non-Proliferation Office (ASNO) call for transporters of UOC to hold permits granted by ASNO, which contain strict security conditions, including a requirement to manage incident response. This ensures that there is a fixed service provider operating as a partner in the transport process, and allows the mine operator to influence key aspects of the transporter’s IRAP.

Movements must operate along approved transport routes with pre-determined stopovers, rest areas and approved in-transit storage or holding locations. This results in disciplined transits and regular contact points en route, and creates a relationship between truck drivers and the mine site gatehouse control operators, which can be important should an incident occur.

Transport drivers are required to have formal training and be licensed to transport dangerous goods. This training provides an opportunity for truck drivers to become familiar with the processes involved in the production, packaging and transport of UOC.

The types of accidents that may occur

There are three possible incidents that may occur during the transport, handling or storage of UOC that will require an incident response. When gathering the facts, ensure that the incident surroundings are safe, or determine what is needed to make the area safe before proceeding with any response.

| Incident type | Description |
|----------------------|---|
| Type 1 | Incidents that do not involve the leakage or spillage of UOC. |
| Type 2 | Incidents involving the leakage or spillage of UOC. |
| Type 3 | Incidents involving any unlawful interruption to the free passage, movement or transportation of UOC, or other form of unplanned delay. |

This information should be detailed in the IRAP to help classify the incident type for emergency response purposes. Examples of the detailed response measures for each incident type can be found at Attachment A.

Further details on incident response measures for personnel responding to a leakage or spillage of UOC can be found at Attachment B.

Key components of an IRAP

An effective IRAP will contain all information needed to support the initial incident response, and details of specific Commonwealth, state or territory regulatory requirements. In most cases the IRAP will be linked to a company's operational transport plan. The IRAP should therefore include references to internal operating procedures regarding incident escalation and management.

Relevant supporting documentation should also be included, such as:

- A flow diagram showing the overall incident reporting, escalation and management processes and interaction of parties required to bring the process under control.
- An incident action card containing key contact telephone numbers;
- Details of the mine security gatehouse and/or the transport service provider from which additional contacts can be accessed; and
- Details of trained emergency responders and those involved in any recovery, cleanup, restoration or decontamination activities.

Table 1 below outlines the key components that should be included in an IRAP.

| | |
|---------------------|--|
| Purpose | To provide a framework for maintaining control, managing and escalating incidents in order to regain control at the operational level, and identifying the structural supporting links for managing major incidents at the corporate level. |
| Scope | The IRAP follows an international approach with applicable local and/or regional requirements. The IRAP applies to parties and agencies that - through their work or involvement - may be required to respond to an incident. |
| Alignment | The IRAP identifies, integrates and references international, federal and state requirements, regulations and safety guides. |
| Risk Assessment | The IRAP identifies and references any risk assessments that have been undertaken to support the IRAP. |
| Incident response | Role of the transporter (truck driver/ train driver/ first on scene): <ul style="list-style-type: none"> - Classify incidents - Assess incidents - Response to each classification - Incident reporting, escalation and management processes - Specific instructions for emergency service responders |
| IRAP support kit | Role of the transporter (truck driver/ train driver/ first on scene):IRAP support kit. Details the basic containment and clean up equipment. The suggested contents of an IRAP support kit can be found at Attachment C. |
| IRAP action card | Checklist for transporters (truck or train drivers). An example IRAP card can be found at Attachment D. |
| Risk to persons | Information about radiation. |
| Incident escalation | Links and information for escalation to corporate level. |

Table 4: Suggested IRAP components.

Other information that should be included in the IRAP includes:

- Product characteristics;
- Radiation characteristics;
- Packaging and securing methodology;
- Safeguarding and security requirements;
- Transport routes;
- Points of export; and
- Shipping line carriers.

The procedures outlined in the IRAP will not differ if the product is in the form of U_3O_8 or UO_4 . Key differences in product form will be detailed in the Safety Data Sheet (SDS) accompanying each container as a part of the Dangerous Goods documentation. An example SDS can be found at *Chapter 4: Safety data sheet for drummed UOC as U_3O_8* .

ATTACHMENT A

Incident response measures

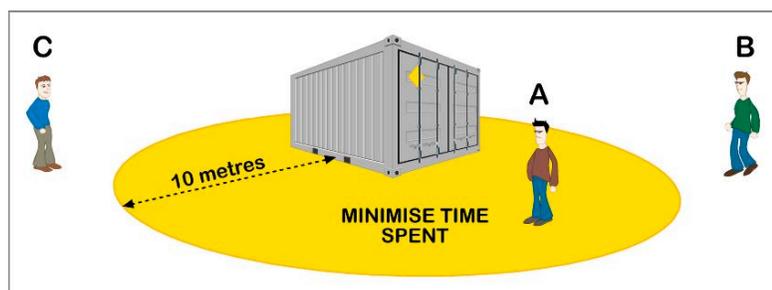
It is important to remember that UOC contains very low levels of radioactivity. The key risks associated with radioactive substances are inhalation, ingestion and exposure. Consider the necessary steps needed to manage and mitigate these risks, and then begin to treat the scene as you would for any other workplace or road traffic incident.

Responding to type 1 incidents - incidents with no leakage/spill of UOC

- Prevent any unnecessary access to the scene, for example by asking passers by for assistance in diverting traffic.
- Use your knowledge of personal safety awareness and the hazards associated with UOC to advise people assisting you that there are no present or impending dangers.
- Ensure everyone involved is aware of the dangers created by the incident.
- There is no reason to open a container that has been involved in an incident to ascertain if its contents have suffered any damage or movement.
- Wait for police and emergency services personnel to arrive. A quick and early assessment of the scene will ensure the early arrival of assistance.

The following diagram indicates the precautions that should be taken to minimise the risk of radiation from sealed shipping containers containing UOC.

Figure 31:
Risk of radiation from
sealed containers
containing UOC
material



Precautions

- A: Minimise time spent in close proximity (within 10m).
- B: Expect normal background radiation levels.
- C: Expect normal background radiation levels.

Responding to type 2 incidents - incidents with spillage/leakage of UOC

Your initial response to a type 2 incident will be similar to that for a type 1 incident, however during the assessment phase you would have identified that there was a spillage or leakage of UOC material, and made an assessment of its size. This information should be relayed to those arranging external assistance.

- Incidents involving a leakage or spillage will result in police and fire service attendance, and specialist cleanup personnel.
- Your role as one of the first on the scene will involve assessing the situation, providing first aid if required, and limiting or preventing access to the area.
- Irrespective of the magnitude of the spillage or leakage, there is no need or requirement for you or others to attempt any cleanup.
- If you need to recover personnel from within the affected area, first consider your own personal health and safety. If available wear gloves, disposable overalls and respiratory protection as a precautionary measure. If such equipment is unavailable, wash your hands and face after completing the recovery of persons. Provided appropriate precautions are taken to avoid inhalation or ingestion, the limited time you might be exposed to the spilt material during the recovery of personnel will have no adverse impact on your health and wellbeing.
- Do not eat, drink or smoke without first washing your hands and face.
- Ensure that anyone involved in the rescue of persons do not leave the scene until all have been checked for any possible radioactive contamination and given the 'all clear'.

Further detail on responding to a leakage or spillage of UOC can be found at Attachment B. The following diagram indicates the precautions that should be taken to minimise the risk of dust inhalation or ingestion from a shipping container containing spilt UOC material.

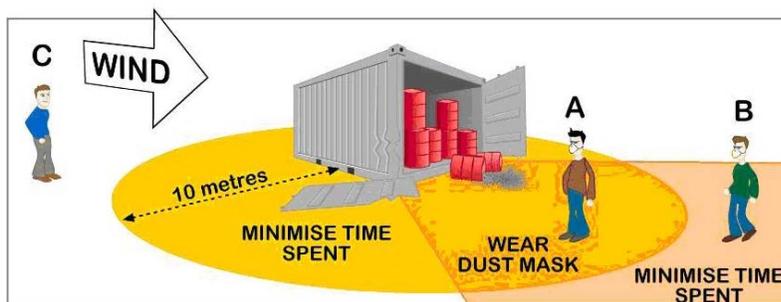


Figure 32: Risk of dust inhalation or ingestion from a shipping container containing spilt UOC material.

Precautions

- A: Wear a dust mask and minimise time in close proximity.
B: Wear a dust mask and minimise time in close proximity.
C: Expect normal background radiation levels, no dust.

Responding to type 3 incidents - incidents involving unplanned delay

Type 3 incidents involve an unlawful interruption to the free passage, movement or transportation of UOC, such as a protest. The police will be involved, and possibly also the media.

The safest place to assess incidents involving protestor activity is from the cabin of the truck, train or forklift that you are operating. Assess the situation and relay this information to your supervisor and/or the emergency services operator. Keep calm and in control. Remain inside the cabin and await the arrival of the emergency services.

Engaging in conversation or interacting with protestors and/or media groups has no effect on resolving protest situations. The police will work through the necessary processes to reinstate normal operations as soon as practically possible. Once the situation has been stabilised, continue your work task as normal.

Security

It is important to maintain the security of the UOC at all times. In particular, it should be ensured that:

- Every person engaged in the handling of dangerous goods exercises reasonable care to avoid damage to packages, unit loads and cargo transport units;
- While dangerous goods are being handled, precautions are taken to prevent unauthorised access to handling areas; and
- If there is any loss of containment/control of dangerous goods, every practical step is taken to minimize risks to persons and adverse effects to the environment.

ATTACHMENT B

Directions for personnel responding to a leakage or spillage

Initial response

- Under the instruction of police or fire services, any transport equipment not involved in the incident must be moved clear of the area.
- The initial containment of any spilled material will be undertaken by the emergency services and the appropriate state/territory agencies, including the relevant state/territory radiation protection branch.
- Before commencing clean up, all persons entering the incident scene must wear protective clothing and equipment to minimise the potential for contamination.
- If there is potential for the spilled material to be spread by wind or heavy rain, or if the spill is too large to attempt clean up without further assistance, efforts should be made to cover the spill, e.g. with tarpaulins.
- In the event of heavy rain, it may be necessary to construct simple earth bunds to provide some form of containment of the spilled material or contaminated soil.
- In the event of a major incident causing material to be spread over a wide area, emergency services personnel must ensure that anyone who may have come into contact with the material is mustered at a pre-arranged point to await further directions.
- The Incident Controller at the site is responsible for all media comment.

Clean up

- Clean up must be undertaken by suitably trained personnel under the advice of the state/territory radiation protection branch personnel and guidance of the senior site emergency services coordinator at the mine.
- Spilled material and contaminated earth must be placed into drums supplied by the mine site. These drums will then be sealed and made ready for removal.
- The emergency services response team at the mine will be responsible for the final clean up of spilled material, the decontamination of equipment and personnel, and the removal of clean up materials back to the mine site. Representatives from the state/territory radiation protection branch will assist with decontamination checks and advise the Incident Controller on clearance following those checks.

After clean up

- Contaminated clean up equipment will be cleaned as best practicable, preferably wrapped in a clean tarpaulin and stored in the clean up container.
- The clean up crew must not be permitted to eat, drink or smoke without first washing their face and hands.
- The clean up crew and others who may have come into contact with the spilled material must wash themselves thoroughly and don clean clothing before leaving the scene.
- Contaminated clothing must be put into plastic bags or other suitable receptacles, sealed and put in plastic wheelie bins from the clean up container.
- Water used for washing must be retained and placed in drums, sealed and made ready for removal.
- The clean up crew must not depart the area until the 'all clear' has been given by the Incident Controller. This all clear will be given on the advice and direction of the state or territory radiation protection branch, and the guidance of the mine site Radiation Safety Team.
- Members of the clean up crew are not permitted to discuss the incident with the media or members of the public, other than as may be necessary to prevent the spread of spilled material. Members of the clean up crew must refer all media personnel to the Incident Controller for information.

ATTACHMENT C

Containment and cleanup equipment

An IRAP support kit containing basic containment and cleanup equipment should be carried in one of the road transport trailers during the transportation between the mine site and the transfer terminals or port.

UOC – Emergency response

| Basic containment and cleanup equipment | Qty per cleanup box | Basic containment and cleanup equipment | Qty per cleanup box |
|--|----------------------------|--|----------------------------|
| Overalls (Tyvek – white disposable) | 4 pairs | Tarpaulins | 2 |
| Elbow length gloves | 4 pairs | Shovels | 2 |
| Reflective safety vests | 4 | Sandbags 30" x 18" | 6 |
| PVC coats | 4 pairs | Barrier mesh (25m) | 100m |
| PVC trouser | 4 pairs | Orange flagging (25m) | 100m |
| Safety goggles | 4 | Dust masks | 4 |
| Large safety traffic cones with reflective sleeves | 6 | Small sledge hammer | 1 |
| CAUTION RADIOACTIVE MATERIAL' metal signs on poles | 4 | Broom | 1 |
| Flashing lights and stands | 4 | Handle | 1 |
| Hazard tape (Caution Tape) – black on yellow | 2 rolls | Dust pan | 1 |
| Torches | 2 each | Tent pegs | 8 |
| Spare batteries | 6 | Star pickets | 8 |

ATTACHMENT D

Example IRAP card

The following is a copy of an example IRAP card that should be carried by each driver, and kept in the Dangerous Goods folder in the cabin of each truck or train.

| |
|--|
| <i>Incident assessment</i> |
| Try to regain your composure, relax, take time to take control of the situation and assess the facts. |
| Check to see if there is any danger to yourself or others. |
| Has anyone been injured? Attend to injured persons and call 000 as required. |
| Contact the Mine Site Security Gatehouse (24-hour emergencies). |
| Provide the Gatehouse staff with the following information: <ul style="list-style-type: none">- Your name, your location and who you work for.- Details of the location of the incident that will allow helpers to clearly identify where you are.- Advise them of the type of incident (refer below for type).- Details of any injured persons.- Details of the conditions at the incident scene. |
| Do not hang up the phone until told to do so. |

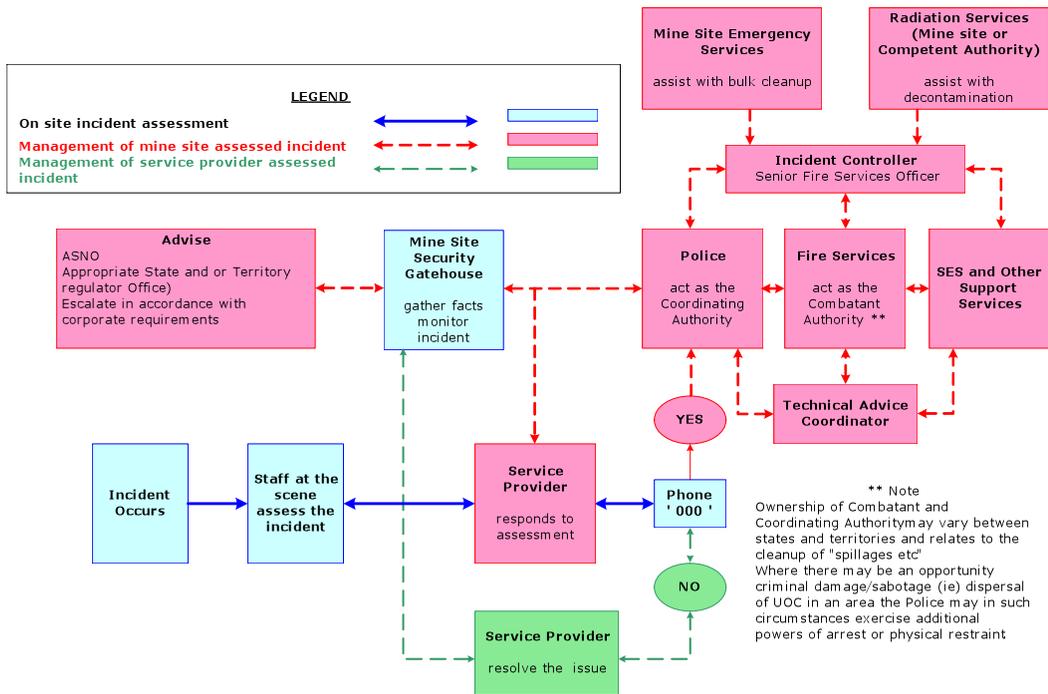
| |
|---|
| <i>Type 1 incident – not involving leakage or spillage</i> |
| Discourage access to the area by making use of the equipment in the response container. Enlist the assistance of onlookers or passers by if needed. |
| There is nothing to gain by opening containers to check their contents. |
| Wait for emergency services to arrive, and then follow instructions given by the Incident Controller. |

| |
|---|
| <i>Type 2 incident - involving a leakage or spillage</i> |
| Discourage access to the area by making use of the equipment in the response container. Enlist the assistance of onlookers or passers by if needed. |
| Cordon off an exclusion zone no closer than three metres from the source of the spillage. Where circumstances permit, greater exclusion distances should be maintained. |
| Should you need to rescue persons within the spillage area, remember your basic personal health and safety requirements. Before commencing any rescue, wear disposable overalls, respiratory protection and gloves. These can be found in the emergency response kit. |
| Avoid the inhalation of UOC by standing upwind of the incident area and by wearing a dust mask. |
| Do not eat, drink or smoke without first washing your hands and face. |
| Care should be taken to avoid spreading UOC via clothing and footwear. |
| Irrespective of the magnitude of the spillage or leakage, there is no need or requirement for you or others to attempt any cleanup. |
| Wait for emergency service personnel to arrive and follow all instructions given by the Incident Controller. |
| Do not leave the scene until all persons have been checked for possible radioactive contamination and given the 'all clear'. |

| |
|--|
| <i>Type 3 incident – unplanned delay</i> |
| In a situation where movement is blocked unlawfully: The safest most comfortable place is to remain within the vehicle and if necessary call and wait for the Police. Follow all instructions given by the Police Forward Commander. Once the Police Forward Commander has brought the situation under control, advise your Transport Coordinator and continue the journey. |
| In all other situations: Follow the instructions of your Transport Coordinator regarding the required action to repair equipment and continue the journey. Do not panic, and remember there is no need to rush. |

ATTACHMENT E

Overview of incident management



Chapter 8:

Guide to the transportation of radioactive materials for testing

Scope

The purpose of this document is to provide guidance for mining or exploration personnel charged with the responsibility of preparing consignments of radioactive material for testing and analysis. This document is consistent with the requirements in the International Atomic Energy Agency (IAEA) *Regulations for the Safe Transport of Radioactive Material 2005 (TS-R-1)*⁴. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) *Code of Practice for the Safe Transport of Radioactive Material 2008 (Code of Practice)* currently adopts the 2005 TS-R-1⁵, and is administered through the state and territory Competent Authorities.

This guidance document is intended as supporting information only; it is not a legal instrument, and the ARPANSA Code of Practice as adopted by various jurisdictions requires adherence in full. You may encounter specific consignments which have factors that differ from those covered in this guidance document, and these must be treated on a case by case basis.

Introduction

Radioactive material is an important part of everyday life, with uses ranging from the generation of nuclear power through to medical and industrial uses of radioisotopes. Testing and analysis is a necessary part of the mining and processing of any material containing naturally occurring uranium. Facilities for testing and analysis are generally located some distance from the mine site, thus transportation of the radioactive material is required.

The transportation of radioactive material is covered by stringent international guidelines to ensure that it is carried out in a safe, secure and efficient manner. There are two main international guidelines that apply to the movement of radioactive material:

- IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1)⁶; and
- International Maritime Dangerous Goods Code (IMDG Code).

These guidelines are usually adopted into legislative regimes together with any individual country, state or region-specific requirements. They are designed to form a common and consistent international framework for the transportation of radioactive material, however their interpretation can be quite challenging.

⁴ The TS-R-1 2005 can be accessed here: http://www-pub.iaea.org/mtcd/publications/pdf/pub1225_web.pdf.

⁵ The 2008 ARPANSA Code of Practice can be accessed here: http://www.arpansa.gov.au/pubs/rps/rps2_2008.pdf.

⁶ The paragraph numbers in both the 2005 and 2009 editions of the TS-R-1 are provided as a reference throughout this document – the 2005 numbers in text, and the 2009 numbers in brackets following. The TS-R-1 2009 can be accessed at: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1384_web.pdf. The IMDG Code adopts the 2009 edition of the TS-R-1. The next TS-R-1 20XX version will be released shortly, and may have different paragraph references again.

This document is intended to give clarification on the transportation of materials for testing that contain naturally occurring uranium, including:

- Uranium oxide concentrate (UOC), either as U_3O_8 , UO_2 or UO_4 , in solid or powder form;
- Uranium ore (where the decay products are in equilibrium with uranium) including uranium ore, crushed rock or drill cores containing recoverable quantities of uranium;
- Disequilibrium materials (where the decay products are not in equilibrium with uranium) such as leached materials or tailings, where the material has had its chemical or physical characteristics altered by additional processing; or
- Returns of any uranium-based materials, in dry or liquid form.

The weight of the consignment sent for testing will vary depending on the type of material. A consignment of UOC will typically weigh up to 5 kilograms. A consignment of uranium ore, disequilibrium or other metallurgical materials can be larger in size, weighing up to hundreds of tonnes.

In the processing of uranium-bearing rock to produce UOC, a number of intermediate and other substances are produced, some of which are radioactive. The transport of these intermediate products is not covered in this guidance document. For further information on the transport of these substances, refer to the ARPANSA Code of Practice or the TS-R-1.

Export Permissions

Exports of uranium, thorium and other materials that contain more than 500 parts per million (0.05% by weight) of uranium and thorium combined are subject to control under Regulation 9 of the *Customs (Prohibited Exports) Regulations 1958* and are regarded as 'controlled materials'. Accordingly, an export permission needs to be obtained from the Department of Resources, Energy and Tourism (RET). Further information on export permissions for these materials can be found at: http://www.ret.gov.au/resources/mining/australian_mineral_commodities/uranium/permissions/Pages/exportpermissions.aspx.

Definitions

The following table defines a set of key terms used in the transport of radioactive material.

| | |
|---|---|
| A1 and A2 values | The activity values of a radioactive material, used to determine the activity limits for the requirements of the TS-R-1. |
| Becquerel (Bq) | A measure of the actual radioactivity of a material. It is determined by measuring the number of disintegrations per unit of time. Disintegration occurs each time a nucleus emits off particles or energy. One Becquerel is equivalent to one disintegration per second. |
| Package | The packaging with its radioactive contents as presented for transport. |
| Excepted package | A package that meets the requirements of paragraph 515 of the TS-R-1 2005 ([514]:2009). |
| Industrial Package Type 1 (Type IP-1) | The most basic form of industrial package used for transporting shipments of low specific activity (LSA) materials. The package is designed to meet the requirements of paragraph 633 of the TS-R-1 2005 ([621]:2009). |
| Sievert (Sv) | A unit used to measure radiation levels for the purposes of radiological protection. It takes into account the biological effects of different types of radiation. The International Commission on Radiological Protection (ICRP) recommends that the maximum permissible exposure to radiation above background levels for those working in the industry is 20mSv/y (millisieverts per year). |
| Specific activity | The specific activity of a material is the number of Becquerels per unit mass, measured in Bq/g (Becquerels per gram). |
| Transport index (TI) | An index number assigned to a package, overpack or freight container. It is a measure of the maximum radiation level at one metre from the package (measured in mSv/hr (millisieverts per hour)) multiplied by 100. The Transport Index for large packages is calculated by multiplying the maximum radiation level measured at 1 metre from the package by an 'area factor', equating to the largest surface area of the package eg. the largest side of the shipping container. |
| United Nations ID Classification of Dangerous Goods | An internationally accepted system of classifying hazardous or dangerous substances. Radioactive materials are classified as Class 7 dangerous goods. |

Transport Guidance

The manner in which radioactive material is handled for transport depends upon the amount of material and its relative hazard. The following is a list of things that need to be considered when transporting any radioactive material:

1. Determine if the material is radioactive

The definition of a radioactive material under the TS-R-1 2005 is any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in paragraphs 402-406 ([402-407]:2009).

As a rule of thumb for transport of UOC and rock materials, the following may apply:

| UOC | Uranium ore | Disequilibrium materials |
|--|---|---|
| Defined as radioactive where the activity concentration is greater than 1 Bq/g and total activity of the consignment exceeds 9,000 Bq. In effect will be any sample over a gram UOC. | Defined as radioactive when it contains more than 80ppm of uranium (1 Bq/g). However, if the material will not be processed to use the uranium (or its decay products), then the limit for being defined as radioactive increases to 800ppm of uranium (10 Bq/g). | A disequilibrium material will need to have its specific and total activity calculated on an individual radionuclide basis. The sum of the components must be below the exemption limits set out in Table 1 of the TS-R-1 2005 (Table 2: 2009). |

2. Determine the UN classification

Both the United National (UN) classification and the Proper Shipping Name of the material are required to be displayed on the package (for excepted packages only the UN number preceded by the letters UN is required). UOC and uranium ore are classified as low specific activity (LSA) LSA-I materials. The relevant UN classifications and Proper Shipping Names applicable to LSA -1 consignments are:

| UN classification | Proper Shipping Name |
|-------------------|---|
| UN2910 | Radioactive material, excepted package – limited quantity of material |
| UN2912 | Radioactive material, low specific activity (LSA-1) |

An “excepted” package is classified as UN2910. All other LSA-1 packages are classified as UN2912.

The following sections indicate the relevant parts of the TS-R-1 to determine if a package is excepted or is low specific activity (LSA) material.

3. Determine if the package is ‘excepted’ or LSA-1

To determine whether a package can be classified as ‘excepted’ for transport, you need check the following:

The allowable transport quantities of the material

A package may be classified as ‘excepted’ if it meets the requirements of paragraph 408 and Table 3 of the TS-R-1 2005 ([422] and Table 5: 2009). Applying the A1 and A2 values from Table 1 in the TS-R-1 2005 (Table 2: 2009) the allowable transport quantities for UOC and ore materials containing uranium are unlimited. For disequilibrium materials, the individual A1 and A2 values in Table 1 in the TS-R-1 2005 (Table 2: 2009) must be used.

The gamma radiation levels on the surface of the package

The next step is to check the gamma radiation level on the surface of the package. The rule (as per paragraph 516 of the TS-R-1 2005 ([515]: 2009) is that:

- If the gamma radiation level on the surface of the package is less than 5µSv/h, the package can be classed as an ‘excepted’ package.
- If the gamma radiation level on the surface of package is greater than 5µSv/h, the packaging must be classed as IP-1 (Industrial Package, Type 1).

The requirements for transporting an ‘excepted’ package are outlined in paragraph 515 of the TS-R-1 2005 ([514]: 2009).

If it does not fulfil the requirements of an ‘excepted’ package then it will need to have the UN classification UN2912 applied as a low specific activity (LSA) material. LSA material is defined in paragraph 226 of the TS-R-1 (2005 and 2009) as “radioactive material which by its nature has a limited specific activity, or for which limits of estimated average specific activity apply”. Paragraph 408 of the TS-R-1 2009 states that radioactive material can only be classified as LSA material if the conditions outlined in paragraphs 226 409-411 and 526-520 are met. UOC and uranium ore are classed as LSA-I material.

For further information you can also refer to the flow chart at Annex C: ‘1. Test for Package Type’ in the ARPANSA Safety Guide for the *Safe Transport of Radioactive Material* (2008), which can be accessed here:

http://www.arpansa.gov.au/pubs/rps/rps2_1.pdf

4. Package material for testing

Samples of radioactive material should be packaged to provide maximum safety and minimum potential for radiation exposure. The aim should be to reduce the radiation levels on the surface of the package. Packaging should be of a type that ensures the total containment of the material.

There are specifications on the type of packaging to be used in the transport of small amounts of radioactive materials for testing. The packaging required depends on the activity and type of the radioactive material to be transported. Examples of possible packaging methods include:

| Rock materials | Disequilibrium materials |
|---|--|
| Drill core materials could be placed in drill trays with lids fitted and then stacked and strapped onto a pallet which is covered in shrink wrap plastic. Crushed materials can be stored in individual plastic bags and then placed in a larger suitable container such as a steel pail, a 200 litre steel drum or a 'CHEP' box. | Disequilibrium materials could be stored in individual plastic bags and then placed in a larger suitable container such as a steel pail, a 200 litre steel drum or a 'CHEP' box. |

'Multiple encapsulation' provides additional layers of protection in the event of a failure of any part of the packaging. As a general rule, provide a minimum of double encapsulation for all dry materials. Triple encapsulation is recommended when the material being transported is in a liquid, gel or slurry form (or when it has the potential to form a free liquid due to vibration or movement during transport and handling operations). Triple encapsulation could include the use of absorbent material around the liquid materials before the secondary containment, or the use of spill collector pallets or shipping containers.

Packaging requirements for LSA-1 material

Below are a set of packaging requirements for all LSA-1 material (for more detail see paragraphs 521-525 of the TS-R-1 2005 ([516-520]: 2009)):

- The packaging should be designed to be easily and safely transported, and properly secured during transport;
- The packaging should be fitted with appropriate lifting and handling features;
- The outer surface of the package should be finished to minimise the chance of contamination, prevent water collecting on it, and allow for ease of decontamination;
- The package should be capable of withstanding conditions encountered during transport; and
- The package should be marked with its weight (if above 50 kg).

Additional requirements apply if the package is to be transported by air. Further information on packaging requirements for transportation by air can be found

through the Australian Civil Aviation Safety Authority website:

<http://www.casa.gov.au>.

Packaging requirements for 'excepted' packages

The packaging for 'excepted' packages must conform to the requirements for LSA-1 material (above), however:

- The package must have the words RADIOACTIVE on internal surfaces to warn of the presence of radioactive material upon opening.
- The package must have 'UN2910' clearly marked and visible on the external surface of the outer packaging (refer to Figure 7 in the TS-R-1 (2005 and 2009) for sign design). If the package is being sent internationally by post it must additionally be plainly and durably marked on the outside with the words 'RADIOACTIVE MATERIAL — QUANTITIES PERMITTED FOR MOVEMENT BY POST'. Details of the contents must be included within the consignor's transport documentation.

Packaging requirements for IP-1 packages

The packaging for 'IP-1' packages must conform to the requirements for LSA-1 material (as above); however an additional requirement is that the smallest external dimension of the package must be no less than 10 cm.

5. Determine the labelling category

Labels are used to give an explanation of the contents of a package by using standard international symbols and codes. Although the package required for transporting radioactive material is based on the activity inside the package, the label required on the package is based on the radiation hazard outside the package.⁷ This categorisation of packages is the responsibility of the consignor.

Labels for radioactive materials require the shipper to write the content of radioactive material, the radiation level at the surface of the package, and the transport index. There are three types of labels for radioactive material. Each category of label represents the potential hazard of the package.

Below is a table of the three types of labels. The fourth column contains an example of a placard, which must be used on the outside of a cargo transport unit (CTU) (or alternatively, the appropriate label enlarged to the dimensions of a placard may be used).

⁷ http://mitnse.files.wordpress.com/2011/03/transportation_11.pdf

Category I-White, II-Yellow and III-Yellow labels must include the type of and activity of the radionuclide being transported. Category II-Yellow and III-Yellow labels must also include the Transport Index. The labels must conform to the requirements set out in paragraphs 542-546 of the TS-R-1 2005 ([536-540]: 2009).



Category I - White

Maximum radiation level at any point on external surface does not exceed 0.005mSv/h



Category II - Yellow

Maximum radiation level at any point on external surface is more than 0.005mSv/h but does not exceed 0.5 mSv/h



Category III - Yellow

Maximum radiation level at any point on external surface is more than 0.5mSv/h but does not exceed 2 mSv/h



Placard Class 7

Generic placard for all categories

If the package is not an 'excepted package', it may require at least II-Yellow labelling (since the surface radiation level is greater than $5\mu\text{Sv/h}$), with the exception of some disequilibrium materials. For larger consignments (such as ISO shipping containers), the labelling category may be III-Yellow, based on its Transport Index.

You can also refer to the flow chart at Annex C: '2. Label Category Test Flow Chart' in the ARPANSA Safety Guide for the *Safe Transport of Radioactive Material* (2008), which can be accessed here:

http://www.arpansa.gov.au/pubs/rps/rps2_1.pdf

Placarding

Placards are large labels that are placed on the outside of a vehicle transporting a radioactive material. Placards should be placed on all four sides of the container. Either the generic radiation placard (Figure 6 in the TS-R-1, 2005 and 2009) or enlarged versions of the package labels can be used.



Figure 33:
Checking for alpha surface
contamination



Figure 34:
Checking for
gamma radiation

6. Final check prior to transportation

An important requirement in the TS-R-1 is that the radioactive surface contamination levels on any external part of the package must not exceed 4 Bq/cm^2 . This can be achieved by ensuring all external and internal packaging is clean and has not been in contact with radioactive material. A 'wipe test' is used to determine the radioactive contamination on the surface of a package.

Packages must be checked prior to shipping to ensure the integrity of the restraints and the internal material packaging. Further information on the packing and shipping of radioactive materials can be found in Chapter 3: *Guide to packing and stowage of shipping containers carrying UOC*.

Summary

The main factors for determining the UN classification of any material include:

- The activity of uranium;
- Whether the material is in equilibrium;
- Whether uranium is to be extracted from the material; and
- The gamma dose rates on the surface of the consignment.

The following table provides a summary for each type of material:

| | UOC | Rock material (in equilibrium) | Disequilibrium material |
|--|---|--|---|
| Is the material radioactive? | Yes | Yes, if > 1 Bq/g (~80ppm) uranium or >10Bq/g (~800ppm) if radionuclides are not to be extracted for use. | Yes, if the sum of individual radionuclides is greater than the exemption levels set out in the TS-R-1. |
| Classification of package | Low specific activity (LSA-1) | Low specific activity (LSA-1) | Low specific activity (LSA-1) |
| Surface gamma dose rate > 5µSv/h | UN2912 | UN2912 | UN2912 |
| Surface gamma dose rate < 5 µSv/h | UN2910 'excepted' package | UN2910 'excepted' package | If the activity levels are within the A1 and A2 values specified in the TS-R-1, it will be classified as UN2910 (an 'excepted' package). If not, it will be classified as UN2912. |
| External surface 'alpha' contamination | Must be no more than 4 Bq/cm ² . | Must be no more than 4 Bq/cm ² . | Must be no more than 4 Bq/cm ² . |

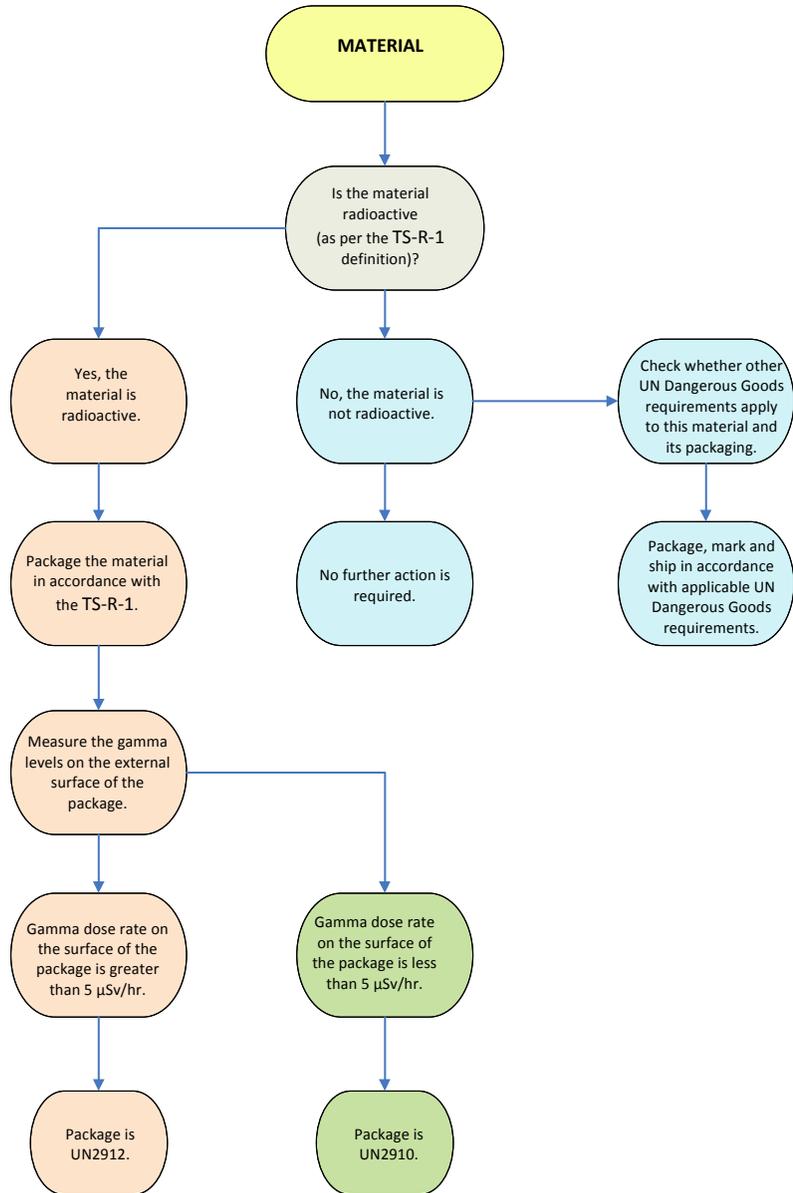


Figure 35:
Guide to the
transportation of
radioactive substances
for testing

Chapter 9:

List of Australian Competent Authorities

Table 1: List of Australian Competent Authorities for the purpose of the Code of Practice for the Safe Transport of Radioactive Material

Table 2: List of other Australian Competent Authorities for the transport of radioactive material by sea or air

| COMMONWEALTH STATE / TERRITORY | CONTACT | COMPETENT AUTHORITY |
|---|--|---|
| Commonwealth | CEO ARPANSA PO Box 655 Miranda NSW 1490 Tel: (02) 9541 8333 Fax: (02) 9541 8314 Email: info@arpansa.gov.au | Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) |
| Australian Capital Territory | Manager Radiation Safety Health Protection Service ACT Health Directorate Locked Bag 5005 Weston Creek ACT 2611 Tel: (02) 6205 1700 Fax: (02) 6205 1705 Email: hps@act.gov.au | Australian Capital Territory Radiation Council |
| New South Wales | Manager Hazardous Materials, Chemicals and Radiation Environment Protection Authority PO Box A290 Sydney South NSW 1232 Tel: (02) 9995 5959 Fax: (02) 9995 6603 Email: radiation@epa.nsw.gov.au | Environment Protection Authority |
| Northern Territory (i) for radioactive ores and concentrates | Chief Inspector – Radioactive Ores and Concentrates (Packaging and Transport) NT WorkSafe Department of Justice GPO Box 1722 Darwin NT 0801 Tel: (08) 8999 5010 Fax: (08) 8999 5141 Email: neil.watson@nt.gov.au | Work Health Authority |
| (ii) for all other radioactive substances | Manager Radiation Protection Radiation Protection Section Department of Health GPO Box 40596 Casuarina NT 0811 Tel: (08) 8922 7152 Fax: (08) 8922 7334 Email: envirohealth@nt.gov.au | Department of Health |
| Queensland | Director, Radiation Health Unit Queensland Health PO Box 2368 Fortitude Valley BC QLD 4006 Tel: (07) 3328 9987 Fax: (07) 3328 9622 Email: radiation_health@health.qld.gov.au | Queensland Health |
| South Australia | Manager, Radiation Protection Environment Protection Authority GPO Box 2607 Adelaide SA 5001 Tel: (08) 8463 7826 Fax: (08) 8124 4671 Email: radiationprotection@epa.sa.gov.au | Minister for Environment & Conservation |
| Tasmania | Senior Health Physicist, Radiation Protection Unit Department of Health & Human Services GPO Box 125 Hobart TAS 7001 Tel: (03) 6222 7256 Fax: (03) 6222 7257 Email: radiation_protection@dhs.tas.gov.au | Director of Public Health |
| Victoria | Team Leader, Radiation Safety Department of Health GPO Box 4541 Melbourne VIC 3001 Tel: 1300 767 469 Fax: 1300 769 274 Email: radiation_safety@health.vic.gov.au | Secretary, Department of Health |
| Western Australia | Secretary Radiological Council Locked Bag 2006 PO Nedlands WA 6009 Tel: (08) 9388 4999 Fax: (08) 9381 0701 Email: radiation_health@health.wa.gov.au | Radiological Council |

| MODE OF TRANSPORT | CONTACT | COMPETENT AUTHORITY |
|------------------------------------|---|---|
| Air Transport | Director, Aviation Safety Civil Aviation Safety Authority GPO Box 2005 Canberra ACT 2601 Email: dq@casa.gov.au | Tel: +61 131 757 Fax: +61 2 6217 1300 or 1300 851 857 Civil Aviation Safety Authority |
| Sea (international and interstate) | Manager, Ship Inspections Maritime Operations Division Australian Maritime Safety Authority GPO Box 2181 Canberra ACT 2601 Email: dangerousgoods@amsa.gov.au | Tel: +61 2 6279 5048 Fax: +61 2 6279 5058 Australian Maritime Safety Authority |

Source: http://www.arpansa.gov.au/pubs/rps/comp_auth.pdf

A list of international Competent Authorities can be found here:

<http://www-ns.iaea.org/downloads/rw/transport-safety/transport-safety-nca-list.pdf>

Australian Safeguards and Non-Proliferation Office (ASNO)

RG Casey Building

BARTON ACT 0221

AUSTRALIA

Phone: +61 2 6261 1920

Fax: +61 2 6261 1908

Email: asno@dfat.gov.au

Web: www.dfat.gov.au/asno

